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DEPARTMENT OF THE ARMY FIELD MANUAL  
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# QUARTERMASTER

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*DEPARTMENT OF THE ARMY FIELD MANUAL*  
*FM 10-13*

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# QUARTERMASTER REFERENCE DATA



*DEPARTMENT OF THE ARMY*

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# **SECTION I**

## **INTRODUCTION**

---

### **I. PURPOSE**

The Quartermaster Corps embraces many diversified subjects each of which is a detailed operation requiring technical skill and knowledge. This manual is designed to provide statistical type information for use in planning for quartermaster operations in theaters of operation.

### **2. SCOPE**

This manual includes data on class I, II, III, and IV supply, packaging and crating, and other information pertinent to quartermaster operations.

## SECTION II

# QUARTERMASTER SUPPLY, GENERAL

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### 3. SUPPLY CATALOGS

a. The following are Quartermaster Sections, DA Supply Catalogs:

QM 1      Introduction and Index (a guide to all sections of the system with explanation of their use).

QM 3-1    List of Items for Troop Issue—Enlisted Men's Clothing and Equipment.

QM 3-2    List of Items for Troop Issue—Wacs' and Nurses' Clothing and Equipment.

QM 3-3    List of Items for Issue to Posts, Camps and Stations.

QM 3-4    List of Items for Issue to Troops—Miscellaneous Organizational Equipment.

QM 5      (Stock) List of Items.

QM 5-1    Pricing Guides.

QM 6      Chest, Kits, Outfits and Sets.

QM 7      Organizational Maintenance Allowances.

QM 8      Field and Depot Maintenance Allowances.

QM 9      List of All Parts.

b. Quartermaster Section 5, DA Supply Catalog is published in the form of a separate catalog for each distinct class of articles. The table in paragraph 4 indicates the individual classes.

#### 4. CLASS NUMBERS

Class number	Items
5	FLAGS AND BUNTING.
7	FUEL. Gasoline and oil (including kerosene and diesel oil) etc.
11	PUMPS AND THEIR PARTS.
13	ENGINE-ROOM AND FIRE-ROOM FITTINGS, SUPPLIES, AND TOOLS.
14	OILS. Greases, illuminating oils, and all lubricants.
17	ELECTRIC APPARATUS—and all accessories, outfits, and parts.
18	INSTRUMENTS OF PRECISION—and all accessories, outfits, and parts.
19	BLOCKS AND RIGGING—and all accessories, outfits, and parts.
21	CORDAGE. Hemp, jute, oakum, twine—including manufactured articles.
22	ROPE WIRE AND WIRE, BARE—including manufactured articles.
24	DUCK. Canvas, tentage—including manufactured articles and accessories.
25	RESALE ARTICLES.
26	FURNITURE.
27	DRY GOODS AND TEXTILES. Bedding, buttons, curtains, cushions, draperies, findings, floor coverings, linoleum, notions, oilcloth, trimmings, upholstery, yarns, etc.
28	BLANK FORMS.
29	TOILET ARTICLES—and all accessories, outfits, and parts.
30	BATHROOM AND TOILET FIXTURES—and all accessories, outfits, and parts.

Class number	Items
31	LIGHTING APPARATUS (nonelectric)—and all accessories, outfits, and parts.
32	FIRE-SURFACING AND HEAT-INSULATING MATERIAL.
33	GASKETS, HOSE, HOSE FITTINGS, PACKING, RUBBER (sheet and strip), and TUBING (flexible)—including manufactured articles.
34	LEATHER. Belting, harness, and saddlery—including manufactured articles.
35	BOOKS. Blueprints, charts, drawings, libraries, maps, newspapers, periodicals, professional publications, etc.
36	MUSICAL INSTRUMENTS. Music and all accessories, outfits, and parts.
37	ATHLETIC EQUIPMENT. Recreational apparatus, sporting goods, and special wearing apparel.
38	BROOMS AND BRUSHES.
39	LUMBER, TIMBER. Wooden barrels, boxes, cases, crates, etc.
40	TOOLS, MACHINE. Bending rolls, drop hammers, drills, grinders, lathes, milling machines, planers, presses, punches, riveters, rolling machines, saws, shears, etc.—including all accessories, outfits, and parts.
41	TOOLS, HAND.
42	HARDWARE (builder's general).
43	BOLTS, NUTS, RIVETS, SCREWS, AND WASHERS.
44	PIPE, TUBES, TUBING (Nonflexible).
45	PIPE FITTINGS.
46	METAL IN BARS (flat, hexagon, octagon, round, square). Billets, ingots, pigs, and slab.
47	METAL IN PLATES AND SHEETS.
51	ACIDS, CHEMICALS, DRUGS, CASES, SOAPS. Abrasive materials and cleaning, cutting, and polishing compounds.
52	PAINTS AND PAINT INGREDIENTS.

Class number	Items
53	<b>STATIONERY.</b> Bags, paper; books, blank; boxes, paper; cartons; and supplies for drafting rooms, offices, and printers.
54	<b>OFFICE EQUIPMENT.</b> Adding machines, cash registers, numbering machines, typewriters, etc.
55	<b>TEXTILE CLOTHING AND KNITTED GOODS.</b>
56	<b>FOOD.</b> Groceries, ice, provisions, and subsistence.
58	<b>RAILWAY, DOCK, AND YARD EQUIPMENT—</b> including fire-fighting apparatus.
60	<b>BOILERS AND ENGINES</b> (power plant and ship)— and all accessories, outfits, and parts.
62	<b>ARTICLES OF SPECIAL VALUE.</b> Bullion, jewelry, museum collections, paintings, precious stones and metals, statuary, works of art, etc.
63	<b>TABLEWARE</b> (barracks, crew's mess, hospital, hotel, officers' mess, ship saloon). Aluminumware, chinaware, corrosion-resisting steelware, glassware, and silverware.
64	<b>BAKE-SHOP AND KITCHEN APPARATUS.</b> Aluminum utensils, corrosion-resisting steel utensils, galley gear, tinware, and all accessories, outfits, and parts.
65	<b>OVENS, RANGES, AND STOVES</b> —and all accessories, outfits, and parts.
66	<b>MACHINERY AND EQUIPMENT.</b>
67	<b>FORAGE.</b> Bulbs and roots, plants, shrubs and trees, and seeds.
68	<b>LIVESTOCK.</b>
69	<b>VEHICLES</b> (animal and hand-drawn)—and all accessories, outfits, and parts.
70	<b>AGRICULTURAL IMPLEMENTS</b> —and all accessories, outfits, and parts.
71	<b>INSIGNIA.</b> Badges, medals, etc.
72	<b>BOOTS, SHOES, AND LEATHER AND RUBBER CLOTHING.</b>
73	<b>CAPS, HATS, GLOVES, AND MEN'S AND WOMEN'S FURNISHINGS.</b>
74	<b>INDIVIDUAL EQUIPMENT</b> (field and landing-force).

Class number	Items
79	BLANK FORMS (for general issue).
91	SPARE PARTS; MOBILE EQUIPMENT.
98	REHABILITATION CLOTHING FOR LIBERATED COUNTRIES.
99	RESALE ITEMS. Clothing for oversea shipment.

## 5. DAY OF SUPPLY

A day of supply is the quantity of supplies estimated to be required for 1 day under the conditions of the operation and for the force stated. The following table is a basis for considering general requirements, and requirements of temperate, amphibious, jungle, and polar operations.

Item	Pounds per man per day	Tons per man per month	Conversion factor	Measurement tons per man per month with 15 percent stowage
<i>General Quartermaster Requirements</i>				
Class I:				
Rations - - - - -	5.33	0.080	2.1	0.168
Class II:				
Quartermaster clothing and equipage - - - - -	.84	.013	2.9	.038
Quartermaster general supplies - - - - -	.60	.009	2.8	.025
Total class II - - - - -	1.44	.022		.063
				.073

See footnotes at end of table.

Item	Pounds per man per day	Tons per man per month	Conversion factor <sup>1</sup>	Measurement tons per man per month with 15 percent stowage
Class III:				
Gas, oil, grease <sup>2</sup> (less AF)	8.26	.124	1.5	.186 .214
AF fuel and lubricants <sup>3</sup>	13.38	.201	1.5	.301 .346
Total class III	21.64	.325		.487 .560
Class IV:				
Quartermaster sales items	2.00	.030	1.7	.051 .059
TOTAL	30.41	.457		.769 .885
<i>Theater A (Temperate) Quartermaster Requirements</i>				
Class I:				
Rations	7.170	.108	2.1	.227 .261
Class II:				
Quartermaster clothing and equipage	.426	.006	2.0	.012 .014
Quartermaster general supplies	.305	.005	2.8	.014 .016

Total class II .....	.731	.011			.026		.030
Class III:							
Gas, oil, grease <sup>2</sup> (less AF) .....	11.400	.171	1.5		.257		.296
AF fuel and lubricants <sup>3</sup> .....	13.400	.201	1.5		.302		.347
Total class III .....	24.800	.372			.559		.643
Class IV:							
Quartermaster sales items .....	2.000	.030	1.7		.051		.059
TOTAL .....	34.701	.521			.863		.993

*Theater B (Amphibious) Quartermaster  
Requirements*

Class I:							
Rations .....	6.710	.101	2.1		.212		.244
Class II:							
Quartermaster clothing and equipage .....	1.000	.015	2.0		.030		.035
Quartermaster general supplies .....	.730	.011	2.8		.031		.036
Total class II .....	1.730	.026			.061		.071

• See footnotes at end of table.

Item	Pounds per man per day	Tons per man per month	Conversion factor <sup>1</sup>	Measurement tons per man per month	Measurement tons per man per month with 15 percent stowage
Class III:					
Gas, oil, grease <sup>2</sup> (less AF)	10.800	162	1.5	.243	.279
AF fuel and lubricants <sup>3</sup>	11.080	.166	1.5	.249	.286
Total class III	21.880	.328		.492	.565
Class IV:					
Quartermaster sales items	1.970	.030	1.7	.051	.059
<b>TOTAL</b>	<b>32.290</b>	<b>.485</b>		<b>.816</b>	<b>.939</b>
<i>Theater C (Jungle) Quartermaster Requirements</i>					
Class I:					
Rations	6.090	.091	1.5	.137	.158
Class II:					
Quartermaster clothing and equipage	.680	.010	2.5	.025	.029
Quartermaster general supplies	.503	.008	2.5	.020	.023

Total class II .....	1.183	.018			.045		.052
Class III:							
Gas, oil, grease <sup>2</sup> (less AF) .....	10.813	.162	1.5		.243		.279
AF fuel and lubricants <sup>3</sup> .....	11.080	.166	1.5	"	.249		.286
Total class III .....	21.893	.328			.492		.565
Class IV:							
Quartermaster sales items .....	2.812	.042	1.7		.071		.082
TOTAL .....	31.978	.479			.745		.857

*Polar<sup>4</sup> Quartermaster Requirements*

Class I:							
Rations .....	10.400	.156	2.1		.328		.377
Class II:							
Quartermaster clothing and equipage .....	.850	.013	2.9		.038		.044
Quartermaster general supplies .....	.400	.006	2.8		.017		.020
Total class II .....	1.250	.019			.055		.064

= See footnotes at end of table.

Item	Pounds per man per day	Tons per man per month	Conversion factor <sup>1</sup>	Measurement tons per man per month	Measurement tons per man per month with 15 percent stowage
Class III:					
Gas, oil, grease, compounds-----	9.000	.135	1.5	.203	.233
AF fuel and lubricants <sup>2</sup> -----	14.000	.210	1.5	.315	.362
Total class III -----	23.000	.345	-----	.518	.595
Class IV:					
Quartermaster sales items -----	2.000	.030	1.7	.051	.059
TOTAL -----	36.650	.550	-----	.952	1.095

<sup>1</sup> Conversion factors are based on average cubage for each item. Measurement tonnage (40 cu. ft.) weight of any item can be found by multiplying the short ton (2,000 lb.) weight of the item by the conversion factor of the item.

<sup>2</sup> Grease and lubricants 2 percent; gasoline and oil 98 percent.

<sup>3</sup> Class III A.

<sup>4</sup> Estimated, based on Arctic test operations.

## SECTION III

### SUBSISTENCE

#### 6. RATION DATA

Type of ration	Per package data			Average weight per ration		Remarks
	Number rations	Weight (lb)	Volume (cu ft)	Packed (lb)	Unpacked (lb)	
Field, type A				6.0	5.2	This is the basic field ration. Components, weight, and volume may vary. Normally, contains maximum of fresh meats, dairy products, fruits, and vegetables, and other perishables.
Operational, type B				5.3	4.3	Same as field ration, with nonperishable items substituted for perishable items.

<sup>13</sup> See footnotes at end of table.

Type of ration	Per package data			Average weight per ration			Remarks
	Number rations	Weight (lb)	Volume (cu ft)	Packed (lb)	Unpacked (lb)		
Small detachment, type 5-in-1.	5	29.0	0.8	5.8	3.7	Nonperishable precooked or prepared food which may be eaten hot or cold.	
Individual, combat, type C-4.	6	41.0	1.1	6.8	4.1	Nonperishable precooked or prepared food which may be eaten hot or cold. Recommended duration of use: 2 days maximum.	
Food, packet, individual, assault, IA-1*.	24	39.0	1.1			Nonperishable precooked or prepared food which may be eaten hot or cold. Packaged so as to be carried by the individual. Recommended duration of use: 1 day.	
Food packet, individual, survival**.						Nonperishable precooked or prepared food which may be eaten	

Sundries, pack**			hot or cold. Packaged in manner suitable for attachment to cartridge belt or carrying in pocket.
			Composed of essential toilet articles, tobacco, and confections necessary in health and comfort of troops.
			Provides spices and condiments for 1,000 field or operational type B rations.
			Composed of fruit juices, soups, milk, etc., required as special nourishment for hospital patients.
			Composed of fruit juices and similar liquid diet items required for patients.
Spice pack, kitchen	Supplement 1,000 rations	40.0	1.2
Special items pack, hospital (hospital supplement ration).	25	50.0	1.4
Special items pack, aid station (beverage pack, aid station).		40.0	2.0
		40.0	1.0

\* Based on tentative specification. Not a complete ration.

\*\* Not yet standardized.

## 7. TIME ELEMENT IN CLASS I SUPPLY

The figures given in the following table are an approximate average for combat conditions; however, they should be used as a guide only where actual experience is lacking:

Work	Daylight (min.)	Dark (min.)
Unloading rations for one division at class I supply point and preparing for distribution to regiments or separate battalions.	120	150
Distribution of class I supplies to regiment by higher echelon at one supply point.	30	30
Distribution of class I supplies to separate battalion by higher echelon or similar unit.	15	15
Preparation of 1 day's class I supplies for issue at regimental or battalion class I supply point.	30	60
Distribution by regimental supply agencies of one field ration (transfer of loads) to kitchens.	15	20
Kitchens to be taken off trucks, set up, and made ready to begin cooking (or vice versa).	20	20
Division of one ration into three meals at kitchens.	15	20
Kitchens (starting hot) to cook and prepare for serving a hot meal.	120	150
Kitchens to prepare a cold noon meal, the issue of the meal to take place usually coincident with the serving of breakfast.	60	90
Serving a hot meal to men from a kitchen truck when majority of men are served at the truck.	45	60
Serving a hot meal to men by means of carrying parties, assuming the kitchen truck not farther than 1,000 yards in rear of the company.	90	120

## RATION BREAKDOWN CHART

## **8. RATION BREAKDOWN CHART**

The ration breakdown chart is exceedingly useful for making rapid and accurate computations of issue. In using the chart it is recommended that a straight-edge or rule be used. For example: assume a ration strength of 2,187 men. One of the items to be issued is evaporated milk at 32 cans per 100 men. Place the lower guide along the line marked 32 on the left. Now take the amount at the intersection of the 2,000 strength column, which is 640; next, at the intersection of 100, which is 32; next, at the intersection of 80, which is 25.6; and then, at the intersection of 7, which is 2.24. The total is 699.84 cans, allowance for 2,187 men.

## 9. SUBSISTENCE STORAGE DATA

The following table is based on storage experience in the United Kingdom:

### *a. Subsistence items best suited for open storage.*

Item	Unit	Item	Unit
Apple butter-----	Can.	Eggs, dehydrated---	Can.
Apple nuggets-----	Do.	Figs-----	Do.
Applesauce-----	Do.	Fruit cocktail-----	Do.
Apricots-----	Do.	Grapefruit juice-----	Do.
Bacon-----	Do.	Beans, lima puree-----	Do.
Beef: Corned-----	Do.	Beef juice-----	Do.
Roast-----	Do.	Hash: Corned beef-----	Do.
Beets, dehydrated-----	Do.	Meat and vegetable-----	Do.
Biscuits, type C sq-----	Do.	Hominy, dehydrated-----	Do.
Bouillon cubes-----	Do.	Cabbage, dehydrated-----	Do.
Butter-----	Do.	Candy, hard-----	Do.
Catsup, tomato-----	Do.	Carrots, dehydrated-----	Do.
Cheese, processed-----	Do.	Catsup, tomato-----	Do.
Cherries, sweet-----	Do.	Cheese, processed-----	Do.
Chicken, boned-----	Do.	Cherries, sweet-----	Do.
Coffee: R & G-----	Do.	Chicken, boned-----	Do.
Soluble-----	Do.	Coffee: Mackerel-----	Do.
Cranberry sauce-----	Do.	Marmalade-----	Do.
Cranberry flakes, dehydrated-----	Do.	Oil, vegetable salad-----	Do.
Crystals, lemon-----	Do.	Onions, dehydrated-----	Do.
Dessert, powdered-----	Do.	Orange and grapefruit juice-----	Do.
		Orange juice-----	Do.
		Ovaltine-----	Do.

Item	Unit	Item	Unit
Peaches-----	Can.	Salmon-----	Can.
Peanut butter-----	Do.	Sardines-----	Do.
Pears-----	Do.	Sauerkraut-----	Do.
Pickles-----	Do.	Sausage:	
Pineapple:		Pork-----	Do.
Juice-----	Do.	Vienna-----	Do.
Sliced-----	Do.	Sirup-----	Do.
Plums-----	Do.	Soups:	
Potatoes:		Assorted-----	Do.
Sweet-----	Do.	Dehydrated-----	Do.
Sweet, dehy- drated.	Do.	Stew, meat and vegetable.	Do.
White-----	Do.	Tea-----	Do.
White, dehy- drated.	Do.	Tomato:	
Prunes:		Cocktail-----	Do.
Dry-----	Do.	Cocktail, dehy- drated.	Do.
In sirup-----	Do.	Puree-----	Do.
Rations:		Tuna fish-----	Do.
Type C-----	Do.	Turkey, boned-----	Do.
Type 5-in-1-----	Do.	Vinegar-----	Keg.

*b. Subsistence items requiring closed storage.*

Item	Unit	Item	Unit
Apples, dry-----	Box, not canned.	Beans—Cont'd	
		Kidney, dry---	Lami- nated paper bag.
Apricots, dry-----	Do.		
Beans:			
Dry, all varie- ties.	Sack, jute or cloth.	Biscuits, type C---	Carton.
		Candy and gum ra- tion kits.	

Item	Unit	Item	Unit
Candy, hard-----	Fiber drum.	Oats, rolled-----	Carton.
Catsup-----	Bottle.	Onion, powdered, dry.	Do.
Cereal: Wheat, un- cooked.	Carton.	Orange juice, con- centrated.	Jar or bottle.
Prepared, as- sorted.	Do.	Peaches, dry-----	Box, not canned.
Chili powder-----	Can.	Pepper, black-----	Can
Cinnamon-----	Do.		or box.
Cloves-----	Do.	Pickles, all varie- ties.	Jar.
Cocoa-----	Carton.		
Coffee, R & G-----	Do.	Powder, baking-----	Can or pack- age.
Corn meal-----	Package or bag.		
Cornstarch-----	Pack- age.	Prunes, dry-----	Box, not canned.
Crackers, soda or graham.	Do.	Raisins, dry-----	Do.
Dessert powder-----	Carton.	Rations: Type 12-in-1	
Extract, lemon and vanilla.	Bottle.	Type D	
Flour-----	Lami- nated paper bag.	Rice, dry-----	Lami- nated paper
Flour-----	Sack.		bag,
Ginger-----	Can.		sack,
Lard or substitute	Carton.		jute,
Macaroni, dry-----	Do.		or cloth.
Milk, evaporated-----	Can.		
Mustard: Dry-----	Carton.	Salt-----	Sack,
Prepared-----	Bottle or jar.		jute, cloth, lami-
Noddles, egg-----	Carton.		nated
Nutmegs-----	Pack- age.		paper bag.

Item	Unit	Item	Unit
Salt, celery-----	Pack-age.	Sugar—Cont'd Granulated-----	Lami-nated paper bag.
Sauce, concentra-ted.	Bottle.		
Seasoning, poultry-----	Can or box.	Tea (British)-----	Box or carton, not canned.
Soda, baking-----	Pack-age.		
Spaghetti-----	Carton.		
Sugar-----	Sack, jute or cloth.	Tobacco kits Toilet goods ration kits.	
Brown-----	Lami-nated paper bag.	Vanilla tablets-----	Can or pack-age.
Confectioners'	Pack-age.	Vinegar----- Vitamin tablets----- Yeast-----	Bottle. Do. Carton, drum, and canned.

*c. Subsistence items suitable for outside storage  
for short periods of time.*

Item	Unit	Item	Unit
Apples:		Beans—Cont'd	
Dry or dehy-drated.	Can.	Lima-----	Can.
Water-packed--	Do.	String-----	Do.
Apricots, dry-----	Do.	String puree---	Do.
Asparagus-----	Do.	Without pork--	Do.
Beans:		Beets-----	Do.
Kidney-----	Do.	Beets, puree-----	Do.
		Berries, water-packed.	Do.

Item	Unit	Item	Unit
Carrots-----	Can.	Oysters-----	Can.
Carrots, puree-----	Do.	Peas-----	Do.
Cherries, sour-----	Do.	Puree-----	Do.
water-packed.	Do.	Peaches, dried-----	Do.
Chili con carne w/o beans.	Do.	Pumpkin-----	Do.
Clams-----	Do.	Raisins, dry-----	Do.
Corn-----	Do.	Spinach-----	Do.
Hominy, lye-----	Do.	Squash-----	Do.
Milk:		Sugar, lactose-----	Do.
Malted, powdered.	Do.	Tomatoes-----	Do.
Skim, powdered.	Drum.	Tomato juice-----	Do.
Whole, powdered.	Can.	Vegetables, mixed-----	Do.

## 10. REFRIGERATION DATA

### a. Requirements.

- (1) Each man will require approximately 3 cubic feet of refrigerated storage space per month of supply.
- (2) Ice requirements (where ice is required) are approximately 2 pounds per man per day.

*b. Army field refrigerators.* The following table gives information on portable units for storage and transportation of foods in a theater of operations.

Model	Name	Net volume (cu. ft.)	Max. no. men served	Weight (lb.)	Dimensions net (in.) *	Shipping volume (cu. ft.)	Kind of power	Remarks
A	Refrigerator, kerosene.	6	24	400	480	36 x 22 x 60	Kerosene-----	At 35° F. and above, offers maximum convenience for hospitals in temporary locations. It is too small for mess service, though relatively heavy. It needs little service but requires proper fuel and cleaning of oil burner.
B	Container, frozen-beef, insulated. <sup>1</sup>	12	-----	150	200	50 x 40 x 22	None-----	Holds eight boxes (400 pounds) of frozen boneless beef. It is recommended for frozen foods from warehouse to point of consumption by truck or air. Frozen food will remain edible for 1 week in it if reasonably protected from the sun. Container is made of plywood, with metal interior,

See footnotes at end of table.

Model	Name	Net volume (cu. ft.)	Max. no. men served	Weight (lb.)	Dimensions net (in.)	Shipping volume (cu. ft.)	Kind of power	Remarks
	Refrigerator, chest-type, portable.	25	100	300	1,500	2,400	94 x 38 x 67	It is a rugged, hand-started refrigerator, portable by air. It is equipped with holdover plates set for 10° F. in 1944 models and for 10° to 40° F. 1945 models; temperature may be converted only by changing solution. It is designed for the shipment and limited storage of frozen beef and for occasional use as mess refrigerator by isolated units of less than company strength. Two refrigerators may be mounted on a 2½-ton

D	Refrigerator, reach-in, portable.	50	200	850	1,650	81 x 38 x 66	130	Gasoline or electricity.	<p>It is a lightweight refrigerator for organizational messes, with automatic operation for temperatures of 30° to 40° F. It is ideal for kitchen service, being equipped with removable food shelves and meat hooks, as well as a separate ice cube compartment which will freeze 48 pounds of ice in 24 hours. The electric power requirement is 110 volts, 50-60 cycles, alternating current, 1 phase. The refrigerator can be knocked down in 20 minutes into four packages.</p>	do	do	do	do
E	Refrigerator, walk-in, portable.	150	600	1,800	3,900	105 x 71 x 82	5,400		<p>It is a heavy, rugged, over-powered refrigerator designed for severe outdoor use with low maintenance. It is a fully automatic</p>				

See footnotes at end of table.

Model	Name	Net volume (cu. ft.)	Max. no. men served	Weight (lb.)	Dimensions net (in.)	Shipping volume (cu. ft.)	Kind of power	Remarks
		Storage	Shipment	Net	Shipping			
F	Semitrailer, refrigerator, 10-ton, 2-wheel.	600	2,400	6,000	7,500	8,000	246 x 97 x 109	1,340 Gasoline---

G	Warehouse, refrigerated, prefabricated?	600	2,400	2 5,706	108 x 144 x 90	2 472	Gasoline or electricity.	This refrigerated warehouse is a well-insulated, knock-down, walk-in refrigerator for use under cover or as a separate building. It is fully automatic with a temperature range from 10° to 40° F. It is powered by a plug-in self-contained refrigerating unit of the blower type. It is suitable for the storage of frozen or perishable foods for long or short periods to supply kitchens in immediate or more remote locations.	This refrigerated warehouse is identical with the model G except that it provides
H	Warehouse, refrigerated, prefabricated?	1,800	7,200	2 12,140	292 x 144 x 90	2 15,334	2 1,048	2 1,048 do	

See footnotes at end of table.

Model	Name	Net volume (cu. ft.)	Max. no. men served	Weight (lb.)	Dimensions net (in.)	Shipping volume (cu. ft.)	Kind of power	Remarks
I	Warehouse, refrigerated, prefabricated. <sup>1</sup>	12,800	3,200	12,300	26,165	522 x 144 x 90	21,603	This refrigerated warehouse is identical with the model G except that it provides three rooms and requires two rooms and requires two plug-in mechanical units. The prefabricated sections permit the location of doors, walls, and plug-in units as local conditions make desirable. Multiple rooms may be adapted for the storage of both frozen foods and fresh or perishable foods in separate rooms. (For installations where still more storage is required, larger models, of 7,000 and 14,000 cubic feet, may be built from standard plans if materials are available.)

three plug-in mechanical units. The prefabricated sections permit the locations of doors, walls, and plug-in units as local conditions make desirable.

Multiple rooms may be adapted for the storage of both frozen foods and fresh or perishable foods in separate rooms. (For installations where still more storage is required, larger models, of 7,000 and 14,000 cubic feet, may be built from standard plans if materials are available.)

The ice cream plant will make and store 640 half-pint servings of ice cream a day. It is of rugged aluminum construction. It uses standard quarter-master ice cream mix, shipped dry in cans and packed with half-pint folded cartons. It may be transported by air or truck.

J	Plant, ice cream, portable.	2.540 gal.	1,300	2,000	80 x 32 x 56	130	do
---	--------------------------------	---------------	-------	-------	--------------	-----	----

See footnotes at end of table.

Model	Name	Net volume (cu. ft.)	Max. no. men served	Weight (lb.)	Dimensions net (in.)	Shipping volume (cu. ft.)	Kind of power	Remarks
K	Plant, ice, portable.	1 ton / day	-----	8,700	10,250	159 x 50 x 54	350	Gasoline ----- The portable ice plant is a ruggedly constructed, self-contained unit, complete with calcium chloride required to make brine. A 3.6- and a 15-ton plant are also available.
L	Unit, plug-in, for refrigerated warehouse.	-----	-----	2,200	3,800	48 x 44 x 81	220	Gasoline or electricity. The unit is used with the prefabricated refrigerated warehouse, one unit being used with the model G warehouse, two with the model H warehouse, and three with the model I warehouse.

<sup>1</sup> Storage capacity at .25 cubic feet per man; shipping capacity computed on basis of frozen boneless beef 2.5 pounds delivered weekly.

\* Without plug-in unit, model L.

## II. CANNED FOOD DATA

*a. Dimensions, capacities, and conversion factors of cans.* The dimensions, capacities, and conversion factors of cans most commonly used in the canning of fruits and vegetables are shown in the following table:

Name	Dimensions*	Water capacity at 68° F. (oz.)	Can equivalents			Cans per case
			No. 2	No. 2½	No. 10	
6Z.....	202 x 308	6.08	0.295	0.203	0.056	48
8Z short.....	211 x 300	7.93	.386	.266	.072	48, 72
8Z tall.....	211 x 304	8.68	.422	.291	.079	36, 48, 72
No. 1 picnic.....	211 x 400	10.94	.532	.367	.100	48
No. 211 cylinder.....	211 x 414	13.56	.660	.455	.124	24
No. 300.....	300 x 407	15.22	.741	.511	.139	24, 36, 48
No. 1 tall.....	301 x 411	16.70	.813	.561	.153	48
No. 303.....	303 x 406	16.88	.821	.566	.154	24 or 36
No. 303 cylinder.....	303 x 509	21.86	1.060	.731	.200	24
No. 2 vacuum.....	307 x 306	14.71	.716	-----	.134	24
No. 2.....	307 x 409	20.55	1.000	.689	.188	24
No. 2 cylinder.....	307 x 512	26.4	1.284	.886	.241	24
No. 2½.....	401 x 411	29.79	1.450	1.000	.272	24
No. 3 vacuum.....	404 x 307	23.9	1.162	-----	.218	24
No. 3 cylinder.....	404 x 700	51.7	2.515	1.735	.472	12
No. 5.....	502 x 510	59.1	2.8744	1.983	.540	12
No. 10.....	603 x 700	109.43	5.325	3.673	1.000	6

\*The first group of digits of column 2 represents the outside diameter of the can; the second group, the height of the sealed can. The first digit of each group represents inches; the second and third digits of each group represents sixteenths of an inch. For example, the 6Z can is  $2\frac{1}{16}$  inches in diameter and  $3\frac{9}{16}$  inches in height.

*b. Case equivalents.* The can equivalents of table 11, column 4, indicate the number of cans needed to equal each of the cans designated in column 1. The No. 2 and No. 2½ case equivalents may be obtained by dividing the number of cans per case (column 5) of the can to be converted by 24 and multiplying the

result by the can equivalents. The following table gives the case equivalents of the more commonly used cans.

Cans (No. per case)	Case equivalents		
	No. 2	No. 2½	No. 10
8Z tall (48)-----	0.84	0.58	0.63
8Z tall (72)-----	1.27	.87	.95
8Z short (48)-----	.77	.53	.58
8Z short (72)-----	1.16	.80	.86
No. 1 (picnic) (48)-----	1.06	.73	.80
No. 1 tall (48)-----	1.63	1.12	1.22
No. 1 square (24)-----		.58	.63
No. 211 cylinder (48)-----	1.32	.91	.99
No. 300 (24)-----	.74	.51	.56
No. 303 (24)-----	.82	.57	.62
No. 303 (36)-----	1.23	.85	.92
12Z vacuum (24)-----	.72		
No. 2 (24)-----		.69	.75
No. 2 cylinder (24)-----	1.284		.96
No. 2½ (24)-----	1.45		1.09
No. 3 (24)-----	1.71		1.28
No. 3 cylinder (12)-----	1.26	.87	.94
No. 10 (6)-----	1.33	.92	

## SECTION IV

# QUARTERMASTER SUPPLIES AND EQUIPMENT

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### **12. ISSUE, REPLACEMENT, AND CONSUMPTION**

*a. Initial issue.* The initial issue of equipment is the provision of equipment approved for issue to troops or other using agencies who have not previously been supplied such equipment. Initial issue include issues to new inductees, issues to newly activated units, issues of new standardized items, issues arising from increases in allowances due to changes in tables of organization and equipment and tables of allowances, items approved for issue in excess of the quantity authorized in approved tables, and items approved for issue to units for which there are no approved tables.

*b. Replacement issue.* The replacement issue of equipment is that portion of the issues made to troops or other using agencies which replaces equipment previously supplied in order that the standards of efficiency prescribed by the Department of the Army will be maintained. Such issue includes replacement of unserviceable equipment, replacement of losses due to wearing out beyond economical repair, abandonment, destruction, enemy action, pilferage, etc.

*c. Consumption issue.* Consumption issue is the issue of an expendable item.

*d. Replacement factors.* A replacement factor is a number, expressed as a decimal, which, when multiplied by the total projected quantity of an item in use, gives the quantity of that item required to be replaced during a given period of time. Replacement factors are usually expressed on a monthly basis.

*e. Consumption rate.* A consumption rate is the average quantity of an item expended or consumed during a given time interval expressed in quantities per applicable basis. Typical bases of consumption rates are gallons per man per day, pounds per man per day, quantity per 1,000 men per month, etc.

*f. Adjustment of replacement factors.* The authorized initial allowances to which replacement factors for clothing and individual equipment apply are listed in the following manner: If the factor is .083 and the initial allowance per individual authorized the item is 2, the replacement factor appears as .083/2. The allowances shown apply only to those individuals who are authorized the item. Should the allowance be changed, the replacement factor must be increased or decreased in inverse ratio to the difference in initial allowance. The following equation may be used to compute the adjusted Z/D or oversea command replacement factor:

$$\text{Adjusted factor} = \frac{\text{Published factor} \times \text{Published allowance}}{\text{command allowance}}$$

*g. Components of chests, kits, outfits and sets.* No factors are shown for complete chests, kits, outfits,

and sets, as replacements for these items are made by components only.

*h. Tables.*

(1) The replacement factors and consumption rates published in SB 38-4-QM, "Replacement Factors, and Consumption Rates—Quartermaster Corps," are specifically based on the assigned missions of the designated requisitioning agencies and areas, and are designed to reflect the replacement and consumption requirements to meet the demands of such requisitioning agencies and areas. The tables to be found in SB 38-4-QM are—

*(a) Replacement factors for—*

1. Clothing, Enlisted Women's.
2. Clothing, Officers', Women's
3. Musical Instruments.
4. Materials Handling Equipment.
5. Petroleum Handling Equipment.

*(b) Consumption rates for expendable supplies:*

1. Miscellaneous Expendable Supplies Except Insect and Rodent Control Items.
2. Laundry Supplies—Items Used Exclusively for Laundry and Dry Cleaning Purposes.
3. Insect and Rodent Control Items.
4. Repair Supplies and Equipment.
5. Major Petroleum Products.

### 13. REPLACEMENT FACTORS, MEN'S CLOTHING (SELECTED ITEMS)

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Apron, baker's, butcher's, and cook's, w/bib	Each	0.500/1	0.560/1	0.500/1
Belt, waist, web, EM, M1937	do			
Boots, service, combat, composition-sole	Pair	.063/2	.067/2	.063/2
Cap:				
Field, cotton, od, w/visor	Each	.048/1	.024/1	.048/1
Garrison, khaki	do			
Garrison, od	do			
Herringbone twill, od	do			
Drawers:				
Cotton, shorts, od and white	Pair	.063/7	.063/9	.048/3
Winter, od	do	.050/2	(*)	.017/6
Glove-inserts, wool	do	.025/2	(*)	.042/2
Glove-shells, leather	do	.056/1	(*)	.063/1
Gloves, leather, heavy	do	.167/1	.184/1	.167/1
Handkerchief, cotton, od and white	Each	.150/6	.050/6	.050/6
Helmet, steel, M-1 (Body)	do			
Hood, jacket, field, M1943	do			
Insignia:				
Collar, EM	do	.042/2	.050/2	.033/2
Collar, "US," EM	do	.042/2	.050/2	.033/2
Shoulder-sleeve	do	.042/12	.038/6	.033/6
Sleeve, chevron, service, cotton (all grades)	Pair	.063/14	.063/14	.063/14

Jacket:	Field, M1943		.083/1	.042/1	.021/2	.021/1	.028/2
	Field, wool, od.	-	.083/1	.042/1	.021/2	.021/1	.028/2
	Herringbone twill, od (regular and special)	-	.056/3	.062/3	.056/3	.062/3	.056/3
Leggings, canvas, M1938, OD (dismounted)			.069/2	.050/2	.050/2	.050/2	.050/2
Liner, helmet, M1		Each					
Mitten shells, trigger-finger, waterproof		Pair	.063/1	(*)	.063/1	.063/1	.063/1
Mittens, insert, trigger-finger		do	.025/2	(*)	.042/2	.042/2	.042/2
Muffler, wool, od		Each	.042/1	(*)	.053/1	.053/1	.053/1
Necktie, cotton, mohair, khaki		do	.042/2		.042/2	.042/2	.042/2
Overcoat:							
Parka-type, w/ pile liner		Each	.030/1	(*)	.042/1	.042/1	.042/1
Wool, od, 32-oz		do	.025/1	(*)	.025/1	.025/1	.025/1
Overshoes, arctic, M1945		Pair	.028/1	(*)	.028/1	.028/1	.028/1
Parka:							
Field, cotton, od		Each	.042/1	(*)	.083/1	.083/1	.083/1
Wet-weather		do	.042/1	(*)	.035/1	.035/1	.035/1
Poncho, lightweight, od		do	.042/1		.072/1	.072/1	.072/1
Raincoat, rubberized, M1938 (dismounted)		do	.042/1		.056/1	.056/1	.056/1
Release, chin-strap, type 1		do					
Shirt:							
Cotton, khaki		do	.014/6		.058/6	.058/6	(*)
Flannel, od, special		do	.042/2		.042/2	.042/2	.042/2
Shoes, service, composition-sole		Pair	.063/2		.067/2	.067/2	.067/2
Shorts, athletic		do	.067/1		.063/1	.063/1	.063/1
Socks:							
Cotton, tan		do	.187/3		.184/3	.184/3	.187/3
Wool, cushion-sole		do	.110/7		.121/7	.121/7	.110/7
Wool, ski		do	.056/6		.056/6	.056/6	.056/6

\*Not authorized.

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Suit, hbt, od, one-piece (regular and special) - - - - -	Each	.083/1	.091/1	.083/1
Supporter, athletic - - - - -	do	.083/1	.091/1	.083/1
Suspenders, trousers - - - - -	Pair	.058/1	.064/1	.058/1
Sweater, high-neck - - - - -	Each	.050/1	.050/1	.050/1
				(*)
Trousers:				
Cotton, khaki - - - - -	Pair	.025/6	.042/6	
Field, cotton, od - - - - -	do	.042/2	.083/1	.042/2
Field, serge, wool, od 33, 18-oz (regular and special) - - - - -	do			
HBT, od (regular and special) - - - - -	do	.067/3	.074/3	.067/3
Wet-weather - - - - -	do	.056/1	(*)	.100/1
Undershirt:				
Cotton, summer, sleeveless, od and white - - - - -	Each	.042/7	.083/9	.033/3
Winter, od - - - - -	do	.058/2	(*)	.028/6

\*Not authorized.

**14. REPLACEMENT FACTORS, INDIVIDUAL AND ORGANIZATIONAL EQUIPMENT  
(SELECTED ITEMS)**

	Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Ax:					
Camp.	do	.028	.028	.028	.028
Entrenching, M1910, w/handle	do	.021	.021	.021	.021
Bag:					
Barrack, od.	do	.033/1	.033/1	.033/1	.033/1
Canvas, field, od., M1936	do	.056	.056	.056	.056
Water-carrying, canvas, 5-gal. (complete)	do	.042	.042	.042	.042
Water-sterilizing, canvas, porous (complete)	do	.021	.021	.021	.021
Carrying-ammunition	do	.042	.042	.042	.042
Carrying, rocket, M6	do	.050	.050	.050	.050
Clothing, waterproof	do	.033/1	.033/1	.033/1	.033/1
Duffel	do	.056/1	(*)	(*)	(*)
Sleeping, arctic	do	.056/1	(*)	(*)	(*)
Sleeping, mountain	do	.056/1	(*)	(*)	(*)
Sleeping, wool	do	.083/1	.125/1	.083/1	.083/1
Bat, insect, field	do	.067/1	.067/1	.067/1	.067/1
Belt:					
Cartridge, .30 cal., dismounted M1923	do	.047/1	.047/1	.047/1	.047/1
Pistol or revolver, M1936	do				

\*Not authorized.

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Blanket:				
Lightweight, M1944	Each	(*)	.017/1	(*)
Wool, od, M1934 (3 3/4 lb)	do	.017/2	.017/2	
Box, match, waterproof	do	.042	.042	.042
Bucket, water, canvas, 18-qt.	do	.037	.037	.037
Can, meat, aluminum	do			
Canteen, aluminum, M1910	do	.038/1	.038/1	.038/1
Carrier:				
Ax, entrenching, M1910	do	.021	.021	.021
Pick-mattock, entrenching, M1910	do	.021	.021	.021
Shovel, entrenching, M1943	do	.021	.021	.021
Wire-cutter, M1938	do	.038	.038	.038
Case:				
Dispatch, canvas, M1938	do			
Bag, sleeping, water-repellent	do			
Chair, folding	do	.017	.017	.017
Comforter, wool-filled	do	.010	(*)	.010
Cot, folding:				
Canvas	do			
Steel	do			
Cover:				
Canteen, M1910 ( <i>dismounted</i> )	do	.050/1	.050/1	.050/1
Mattress	do		.021/2	.021/2
Cup, canteen, corrosion-resisting-steel	do		.038/1	.038/1
Cutter, wire, M1938	do		.028	.031

Desk:	Field, fiber, company (empty)	do	.017	.017	.017
	Field, M1945	do	.017	.017	.017
Flag:	Guidon, hunting	do	.012	.042	.042
	National ensign, U. S. bunting, storm	do	.333	.333	.333
Fly, tent, wall:	Large	do	.042	.042	.042
	Small	do	.042	.042	.042
Fork, M1926	Goggles, plastic, lens	do	.042	.042	.042
	Headnet, mosquito, M1944	Pair	.042/1	.042/1	.042/1
Kit, barber, w/case, M1944	Kit, barber, w/case, M1944 (refer to applicable components).	Each	.042	.042	.042
Knife:	M1926	do	.042/1	.042/1	.042/1
	Pocket, general-purpose	do	.021	.021	.021
	Locker, trunk	do	.017/1	.017/1	.017/1
	Mattress, cotton	do	.017/1	.017/1	.017/1
Pack, field:	Cargo, M1945	do	.033/1	.033/1	.033/1
	Combat, M1945	do	.033/1	.033/1	.033/1
	Packboard, aluminum	do	.021	.021	.021
	Paulin, canvas, khaki or od.	do	.042	.042	.042
	Large	do	.042	.042	.042
	Small	do	.042	.042	.042
	Pick, mattock, entrenching, M1910, w/handle	do	.021	.021	.021
	Pillow, feather	do	.017	.017	.017
	Pillowcase	do	.042/2	.042/2	.042/2

\*Not authorized.

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Pin, tent:				
Aluminum, 9-inch	Each	.042/5	.042/5	.042/5
24-inch	do	.056	.056	.056
16-inch	do	.056	.056	.056
Pocket, cartridge, .30 cal. M1, carbine or rifle	do	.021	.021	.021
Pole, tent:				
Ridge, 7-ft.	do	.042	.042	.042
Ridge, 9-ft.	do	.042	.042	.042
Ridge, jointed, 11-ft, 10½-inch (complete)	do	.042	.042	.042
Ridge, jointed, 17-ft (complete)	do	.042	.042	.042
Single-section	do	.038/3	.038/3	.038/3
Upright, 4-ft, 9-inch	do	.042	.042	.042
Upright, 5-ft, 8-inch	do	.042	.042	.042
Upright, 6-ft, 2-inch	do	.042	.042	.042
Upright, 7-ft	do	.042	.042	.042
Upright, jointed, 7-ft, 2-inch (complete)	do	.042	.042	.042
Upright, 12-ft, 3-inch (all types)	do	.042	.042	.042
Pouch, first-aid packet, M1942	do	.042/1	.042/1	.042/1
Rucksack	do	.033	.033	.033
Screen latrine	do	.042	.042	.042
Sheet, bed, cotton	do	.042/4	.042/4	.042/4
Shovel, entrenching, M1943	do	.021	.021	.021
Spoon, M1926	do	.042/1	.042/1	.042/1
Stand, heating, cup, canteen	do	.067	.067	.067
Strap, carrying, general-purpose	do	.042	.042	.042

Strap-quick-release, packboard, type 1	do	.056	.056	.056	.056
Suspender:					
Belt, M1936	do				
Pack, field cargo and combat	do	.042/1	.042/1	.042/1	.042/1
Tag, identification, M1940	do	.063/2	.063/2	.063/2	.063/2
Tent:					
Post, command, M1945	do	.042	.042	.042	.042
Shelter-half	do	.042	.042	.042	.042
Squad, M1942	do	.042	.042	.042	.042
Wall, od (large)	do	.042	.042	.042	.042
Wall (small)	do	.042	.042	.042	.042
Whistle, thunderer	do	.063	.063	.063	.063

## 15. REPLACEMENT FACTORS, GENERAL SUPPLIES (SELECTED ITEMS)

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Ax, chopping, single-bit, handled, 4 lb	Each	0.042	0.042	0.042
Bar, wrecking, gooseneck, $\frac{3}{4}$ x 24-inch	do	.032	.032	.032
Brace, bit, ratchet, 10-inch	do	.033	.033	.033
Brush, dust, counter	do			
Bucket, general-purpose, iron, extra heavy, 14-qt, w/o lip, galvanized	do			

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Can, corrugated, galv, w/cover:				
10-gal.	Each	.042	.042	.042
16-gal.	do	.042	.042	.042
24-gal.	do	.056	.056	.056
32-gal.	do	.042	.042	.042
Water, 5-gal.	do	.042	.042	.042
Cart, hand	do	.042	.042	.042
Clock, alarm	do	.042	.042	.042
Container:				
Food, insulated, M1944	do	.042	.042	.042
Fuel, 1-qt.	do	.042	.042	.042
Fork, table	do	.042	.042	.042
Frame, hacksaw, adjustable, 8- to 12-inch	do	.056	.056	.056
Hammer, curbed-claw, bell-faced, 1lb, carpenter's	do	.042	.042	.042
Hatchet, claw, 4-in cutting edge	do	.021	.021	.021
Heater, immersion-type, for can, corrugated	do	.021	.017	.028
Knife, table, grille	do	.042	.042	.042
Lantern, gasoline, leaded-fuel	do	.042	.042	.042
Lock, pad, brass, 1½- and 2-inch	do	.030	.030	.030
Machine:				
Duplicating, stencil, paper, 8- x 13-inch	do	.011	.011	.011
Paper-fastening, lever or plunger type wire staple preformed	do	.060	.060	.060
Marking, outfit:				
Stamping-leather, M1910	do	.017	.017	.017
Stamping-metal	do	.021	.021	.021

Mattock, pick, 5lb, w/o handle	.011	.011
Measure, ungraduated, lipped, cap 1 qt.	.042	.042
Oiler, steel, straight-spout, spring-brn, cap $\frac{1}{2}$ pt, dia. 3 in	.008	.008
Opener:		
Box-and-crate, steel, 3 x 8½-inch	.090	.090
Can, hand	.300	.300
Outfit:		
Cooking, 1-burner	.017	.017
Cooking, detachment	.do.	.do.
Cooking, 2-burner	.017	.017
Officers' mess, M1941 (complete)	.do.	.do.
Pick, railroad, 6-7 lb, w/o handle	.028	.028
Puller, nail, 18-inch	.021	.021
Rake, general-purpose, 14-tooth	.028	.028
Range:		
Army, No. 5	.008	.008
Field, M1937 (pack A)	.do.	.do.
Field, M1937 (pack B)	.042	.042
Receptacle, waste paper, fiber, round, 14 x 12 x 16-inch	.do.	.do.
Roll, commissary (complete)	.do.	.do.
Safe, field, combination lock	.011	.011
Saw:		
Butcher's, 22-inch-blade	.do.	.do.
Crosscut, hand, 20-inch, 10-point	.042	.042
Scale, weighing, platform, folding, Army & Navy type, cap 300 lb	.010	.010
Screwdriver, common, normal-duty:		
3-inch	.do.	.090
6-inch	.do.	.071
8-inch	.do.	.083
12-inch	.do.	.120

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Spoon, table:				
Medium	Each	.060	.060	.060
Serving	do	.042	.042	.042
Stencil outfit, $\frac{1}{2}$ & 1-inch, c/w figures and letters	do	.021	.021	.021
Stove:				
Cooking, gasoline, 1-burner, M1941	do	.021	.021	.021
Cooking, gasoline, 1-burner, M1942	do	.021	.021	.021
Tent, M1941 (complete)	do	.021	.021	.021
Table, camp, folding	do	.021	.021	.021
Tool set:				
Carpenter's No. 1	do			
Carpenter's No. 2	do			
Electrician's, No. 1	do			
Electrician's, No. 2	do			
Plumber's	do			
Typewriter, portable, w/carrying case	do	.028	.028	.028
Wrench, adjustable, crescent-type, $1\frac{1}{16}$ x 8-inch	do	.065	.065	.065

## 16. EXPENDABLE SUPPLIES, CONSUMPTION RATE (PER 1,000 INDIVIDUALS PER MONTH) (SELECTED ITEMS)

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Bags, greaseproof and waterproof, type I, Grade A, 6" x 10"	Each	1.500	10.000	10.000
Bags, paper, kraft, grocers', self-opening, 2-lb.	do	200.000	500.000	132.000
Band, rubber 1/4 lb., box, No. 18	Box	4.675	.815	.800
Binder, looseleaf, 3 rings, 1" Cap. 11" x 8 1/2"	Each	11.581	5.000	5.500
Book, blank, note, stenographer's, board-cover, 80 leaves, 6 x 9"	do	32.000	17.000	17.000
Broom, corn (weight 32 lbs. per doz.)	do	60.000	50.000	50.000
Broom, rattan, push, w/o handle	do	4.500	2.500	2.500
Brush, marking, No. 3, 15/64	do	.400	.080	.300
Calcium hypochlorite, tube, c/w testing tablets	tube	11.159	173.544	122.279
Card, guide, blank, P-1 tabs, buff, collated, 1/8 cut, 3" x 5"	do	308.000	178.000	100.000
Card, index, filing, chemical wood, white ruled 91-lb., basis 3" x 5"	do	3475.000	1800.000	1800.000
Compound, dishwashing, type I, H.W	Pound	154.503	95.162	39.970
Envelope, common-type, SO, kraft blank, 4 1/8" x 9 1/2"	Each	550.000	250.000	220.000
Envelope, common-type, 80, kraft, printed, 4 1/8" x 9 1/2"	do	600.000	300.000	300.000
Envelope, common-type, SO, white blank, 4 1/8" x 9 1/2"	do	375.000	75.000	75.000
Fastener, paper, flex., metallic plain, comp., 2 3/4" bet. prongs, 2-in. cap. (50 to box)	Box	10.000	25.000	25.000
Fuel, ration heating, 5-man meal	Each	4.257	3.012	4.760
Handle, broom, rattan, push, 51"	do	4.400	1.500	1.500
Label, paper, blank, gummed, oblong, white, w/red border, 2 1/2" x 1 1/16" (40 per box)	Box	7.000	4.500	4.500
Pad, memorandum, sub 16, white, ruled 8" x 10 1/2" (100 sheets to pad)	do	200.000	112.000	112.000
	Exact			

Item	Unit	Zone of interior	Semitropical and tropical bases	Cold weather bases
Paper, typewriter, bond, sulphite, sub 16, white, 8" x 10½"	Rream	75.000	25.000	20.000
Paper, typewriter, manifold, sulphite, sub 9, white, 8" x 10½"	do	100.000	35.000	35.000
Soap, ordinary-issue.....	Pound	1789.000	2000.000	2299.000
Sponge, cellulose, No. 8	Each	4.200	1.400	2.200
Tablet, water purification, individual, chlorine (100 to 6tl) 2	Bottle	7.040	50.749	136.665
Twine, cotton, wrapping, 12 ply (2 lb cone)	Pound	10.500	34.372	19.826
Twine, jute, baling, sacking or wrapping, type B, 6 ply (570 yds per lb)	do	1.475	1.222	.043

## 17. STORAGE DATA

The following list is based on storage experience in the United Kingdom. These items are suitable for open storage.

*a. Individual clothing.*

Overshoes, arctic

*b. Organizational clothing.*

Gloves, waterproof, rubberized  
Headbands, helmet, steel, M1  
Helmet, steel, M1 (body)  
Liners, helmet, steel, M1  
Mittens, asbestos

*c. Individual equipment.*

Bag—

Barracks  
Field, canvas, olive-drab

Belts—

Cartridge, .30-caliber (dismounted)  
Cartridge, .30-caliber (mounted)  
Magazine, BAR  
Pistol, revolver, or carbine

Cans, meat

Canteens

Carriers, pack

Covers, canteen—

Dismounted

Mounted

Cups

Haversacks

Pockets, magazine, double-web

Pouches, first-aid

Rolls, bedding, waterproof

Straps, carrying, bag, field

Suspenders, belt

Tags, identification

Tent, shelter-half

*d. Miscellaneous organizational equipment.*

Axes, entrenching

Bags—

    Mail, canvas

    Water-sterilizing, canvas

Bandoleer, gas-grenade

Bar, sandfly

Basins, canvas, folding

Buckets, canvas, folding, 8-quart

Carrier—

    Ax, entrenching

    Pick-mattock, entrenching

    Shovel, entrenching

    Wire-cutter

Case—

    Dispatch, canvas

    Magazine, 50-round, with shoulder strap

    Magazine, 5-pocket, 20-round

Clubs, MP

Flies, tent

Machetes, 18-inch-blade, M1942

Paulins, canvas (large)

Pick-mattock, entrenching

Pins, tent

Poles, tent (all types)

Ropes, drag, with shoulder strap

Scabbards—

    Bolo

    Rifle

    Sub-machine-gun

Screens, latrine, complete with pins and poles

Sheath, machete

Shovel, entrenching

Sling—

    Bugle or trumpet

    Carrying, machine-gun and ammunition

    Web, for colors

    Tents (all types)

*e. Barrack equipment.*

Bedstead, single, aluminum-finish  
Cots, folding, canvas

*f. Regular supplies.*

Arrester, spark

Ax—

Camp or hunter, handled

Hand, single-bit, standard grade, 4-pound

Bars—

Crow, pinch-point

Crow, wedge-point

Wrecking, type D, gooseneck,  $\frac{3}{4}$ - by 24-inch

Basins, wash

Brooms—

Corn

Push, rattan, without handle

Brushes—

Dust, counter

Kitchen, wire

Marking

Sanitary or toilet, type II, 17-inch handle

Scrubbing, floor

Sweeping, floor, without handle, 18-inch

Buckets, general-purpose, galvanized, 14-quart, without lip

Bulb, electric, lantern, hand

Candles, type 2

Cans, galvanized—

10-gallon, with cover

16-gallon, with cover

24-gallon, with cover

32-gallon, with cover

Cement, liquid, tent-patching

Cleavers, butcher, 8-inch blade

Container, water, 5-gallon

Compound, rust-preventive

Cups, coffee

Diggers, post-hole

Dippers, tea, 2-quart

Disinfectant, pine-tar, 5-gallon-can

Dubbing, 2-ounce-can  
Forges, portable, blacksmith, type 2  
Funnel, tin, 1-quart  
Glassware, tumbler, water  
Gloves, lantern, gas  
Grater—  
    Nutmeg, tin, 5-inch  
    Vegetable  
Grates, wood-burning  
Griddle, cast-iron, 20- by 30-inch.  
Grinders, brake, power-operated, diameter of wheel,  
    6 inches  
Grindstone, nonglaze  
Hammers, claw, carpenter's, 1-pound  
Handle—  
    Ax, single-bit, 36-inch  
    Broom, push, rattan, 51-inch  
    Hammer, 16-inch, blacksmith's  
    Hammer, claw, 14-inch, carpenter's  
    Hatchet, claw, 14-inch  
    Mop, spring, lever  
    Pick, 36-inch  
    Rake, garden, 66-inch  
    Shovel, 30-inch, D-grip  
    Sledge, 36-inch  
Hatchets—  
    Broad or bench, 5½-inch  
    Claw, with 4-inch cutting edge  
Hooks—  
    Box, 10-inch length  
    Brush, handled, 11½-inch  
    Grass, curved-bladed  
    Hay  
Irons, clinching  
Knife, round, 5-inch, saddler's  
Ladder, step, 8-foot  
Ladles—  
    3¾-inch bowl diameter  
    6-inch bowl diameter  
Lanterns, kerosene

Locks, pad, brass, 1½- by 2-inch  
Mallet, round, 3½- by 5½-inch, carpenter's  
Mashers, potato, 3½- by 18-inch  
Mattock, handled—  
    Cutter type 2  
    Pick type 2  
Measure, tin-lipped—  
    4-quart  
    2-quart  
    1-quart  
    ½-quart  
Mops, cotton, without handle  
Mover, car  
Oil, neat's foot  
Pans—  
    Baking and roasting, 3- by 12- by 24-inch (12  
        rations)  
    Baking and roasting, aluminum, with cover  
    Dust, hood pattern, 12-inch  
    Fry, diameter, 11 inches  
    Bake, tin  
Picks, R. R., handled, 6- to 7-pound  
Pipe, stove, 4- by 24-inch  
Pitcher, water, 5½-quart  
Plate—  
    Cook-pot, splash, for 15 gallons  
    Dinner, 9½-inch-diameter  
    Soup, 9-inch-diameter  
Platter, meat  
Pliers—  
    Slip-joint, combination, wire-cutting type, 6-inch  
    Side-cut, length 8 inches  
Pokers, stove, 20-inch  
Polishes, metal, liquid  
Pot—  
    Cook, aluminum, 15-gallon  
    Marking, tin  
    Mustard, unhandled  
    Stock, 10-gallon, with cover  
    Stock, 15-gallon, with cover

Puller, nail, 18-inch

Rake—

- Fire
- Garden, steel, 14-tooth

Rolls, commissary

Safe—

- Field, key-lock
- Office, key-lock (large, medium, or small)

Saucer, coffee, 7-inch-diameter

Scales, platform, 2,000-pound

Scoop, flour or sugar

Scrapers, dough, 6-inch

Screwdriver

Scythes—

- Bush
- Grass
- Weed

Shaker—

- Pepper
- Salt

Shears, straight-cut, type A, tinner's

Shovels—

- D-handled, square-point, No. 2
- D-handled, round-point, No. 2
- Long-handled, round-point, No. 2

Skimmers, 5- by 15-inch

Sledges, double-faced, 6- to 8-pound, blacksmith's

Spades, garden, square-point, D-handled

Stoves, tent—

- M1941
- Sibley

Table—

- Camp, folding
- Mess
- Office, wood

Tetrachloride, carbon

Tray, mess, 6 compartments

Truck—

- Barrel, warehouse, 2-wheeled
- Barrel, warehouse, 4-wheeled

**Truck—Continued**

Platform, warehouse, 1-ton

Tub, foot, rubber

Vises, pipe, capacity  $\frac{1}{8}$  to  $2\frac{1}{2}$  inches

Washers, plate, iron or steel,  $\frac{5}{8}$ - by  $1\frac{3}{14}$ - by  $1\frac{1}{16}$ -inch

Wedges, steel, woodchopper's

Wheelbarrow, wood frame and steel tray, 4-cubic foot

Wrenches, pipe

## 18. TENTAGE

Type of tent	Size			Number of men accommodated	Weight (pounds)*	Pins and poles	Tent only	Bulk in storage (cubic feet)*	Comments
	Floor dimensions	Height of ridge	Height of side wall						
Tent, squad, M1942.	16' x 32'	12'	4'6"; door; 6'2".	12	255	147	10.9	5.9	The M1942 squad tent is the basic tent of the Army. It was developed to replace all other medium-sized tents, including pyramidal, storage, and wall (large). It is also a partial replacement for the hospital ward tent, being used in medical units having less than 500 beds. It has twice the floor space of the pyramidal tent and can accommodate 12 men and their individual equipment comfortably.
Tent, squad, M1945.	16' x 32'	12'	4' 6"; door; 6' 2".	12	275	150	11.1	6.1	This tent supersedes the M1942 squad tent. It is similar in appearance but represents a new principle in design. Framework of webbing carries the strain normally carried by the canvas. The canvas in the tent is supported by the webbing and will outlast the canvas in previous tents.

Fly, tent, squad.	20' x 37' $7\frac{1}{2}''$ .	12'	5' 3"	190	62	4.25	5	This tent was developed for use with the squad tent when used for hospital purposes as a means of controlling interior temperature in the tent. Limitations on supply of duck have prevented consideration of its issue for general personnel purposes.
Tent, pyramidal.	16' x 16'	12'	4' 6"	130	94	6.2	3.6	Prior to standardization of the squad tent, the pyramidal tent was the basic tent of the Army as well as the Navy. The design antedates the last war. In addition to its inefficient use of material, this tent places a greater strain on canvas than the squad tent due to the concentration of the entire structural strain in a small area of the tent at the peak.
Tent, wall (small).	8' 10" x 9' 2"	8' 6"	3' 9"	2	55	3.4	4.1	This tent is issued chiefly for officers' quarters in the field. It represents an inefficient use of canvas because of the small number of men accommodated for a given yardage.
Fly tent, wall (small).	15' 6" x 9' 2 $\frac{1}{2}$ "			2	23	3.1	.7	Under some circumstances, this tent fly may be erected as a temporary shelter where side walls and ends are not required.

\*See footnote at end of table.

Type of tent	Size			Number of men accommodated	Weight (pounds)*	Bulk in storage (cubic feet)*	Comments	
	Floor dimensions	Height of ridge	Height of side wall	Tent only	Pins and poles	Tent only	Pins and poles	
Tent, pyramidal (light-weight).	11' (dia.).	8' 6" -----	2' -----	4-6	37	2	.2	This tent is a man-portable shelter for mountain troops or for use in terrain where absence of roads prevents vehicle transportation.
Tent, sectional, hospital.	18' x 54'.	12' -----	6' -----	24	771	327	31.5	12.2
Tent, ward, hospital.	16' x 50'.	12' -----	4' 6" -----	20	390	269	20.5	9.6
								This tent is similar in construction to the squad tent, as originally standardized, but 50 feet in length.

Fly, tent, ward, hos- pital.	20' x 54'. 12' -	5' 3" -	193	225	101	7.6	4.5	This fly was developed for use with the hospital ward tent, as a means of controlling interior temperatures in the tent.
Tent, operat- ingsur- gical, (heavy).	18' x 54'. -	11' 1 1/4". 6' -	817	876	38.8	23.2	This tent, now replaced by the hospital sectional tent, was originally designed for operating purposes with a pole frame to eliminate center poles and leave the center area free for operating tables.	
Tent, truck, surgical operat- ing.	16' x 27'. -	12' -	7'	252	75	10.3	3.5	This tent was designed to provide extra floor area for medical units provided with a surgical operating truck. Pro- vided with a canvas floor and a tent liner, it can stand by itself if truck has to pull away from the tent in an emergency.
Tent, com- mand post, M1942.	7' x 11'. 10 1/2". -	7' -	6' -	2	112	5	3.71	This tent was designed as a blackout <sup>†</sup> tent, with high side walls to permit maximum utilization of interior floor space. It has a blackout vestibule entrance and a mail pouch, which al- lows messages to be received and sent without the messenger entering the tent.

\*See footnote at end of table.

Type of tent	Size			Number of men accommodated	Weight (pounds)*	Bulk in storage (cubic feet)*	Pins and poles	Tent only	Comments
	Floor dimensions	Height of ridge	Height of side wall						
Tent, command post, M1945.	10' x 13'	9' .....	6' .....	3	165	92	6.3	3.55	This tent supersedes command post tent. It has insect netting side walls and is equipped with a liner to insulate the tent against heat and cold. A stovepipe outlet is provided, which the old tent did not have. A new design blackout door permits easy entrance and exit of litter bearers when the tent is used for first-aid stations.
Tent, shelter, maintenance.	18' 2" x 26' 2 $\frac{1}{2}$ "	13' 7 $\frac{3}{4}$ "	5' 6"	-----	499	Frame 755	26.3	58.0	This tent, which has a metal frame, thereby omitting interior poles and permitting entrance of the vehicle, is used as a shelter for repair of tanks and other heavy vehicles under cold climate conditions where it is not possible to make repairs in the open. A zipper-closed opening in the roof allows the removal of the vehicle engine by a crane on the outside of the tent. The tent is provided with

Tent, wall (large).	14' 6" x 14'.	11' . . . . .	4' 6" . . . . .	8	130	233	5. 8	3. 1	ground cloths for floor men working under vehicles.
Fly, tent, wall (large).	21' 6" x 14' 3".	.....	.....	.....	50	13	1. 6	. 7	This tent is used chiefly by staff units concerned with supply and main- tenance functions, as well as by pack medical units.
Tent, storage.	17' 10" x 20' 1".	13' . . . . .	5' 3" . . . . .	.....	200	202	9. 6	9. 2	This tent is a large wall-type tent, originally intended for field ware- house purposes. It has high side walls and is equipped with a fly.
Fly, tent, storage.	25' x 20' 5".	.....	.....	.....	85	20	2. 8	. 8	
Tent, assem- bly.	40' x 80'	21' . . . . .	8' . . . . .	.....	80	1100	655	23. 3	This tent, whose principal issue is one per organization with chaplain at- tached, is so designed that when used as an assembly tent it can accom- modate approximately 450 men. It is designed in sections which lash to- gether with lacing lines. The side walls also are in separate sections and may be rolled up or removed when weather conditions permit.

\*These figures are approximate averages. Due to variations in the quality of the fabric and in the amount of finish added, as well as in the types of material used in pins and poles, considerable variation will occur in actual measurements.

## 19. QUARTERMASTER SPECIAL PURPOSE VEHICLES AND EQUIPMENT

Name	Weight	Shipping dimensions				Remarks
		Length (in.)	Width (in.)	Height (in.)	Cu. ft.	
Mixing outfit, dry whole milk	915	96 $\frac{3}{4}$	43 $\frac{1}{2}$	38	125	32
						The equipment consists of a portable electric mixer which is attached to the milk can, an electric cooler, 8 10-gallon milk cans, a strainer, and a stirrer. The mixer operates at only one speed. 160 gallons of milk are the daily capacity of the outfit.
Bath-unit, field, mobile 12-show-erhead.	3,800	106	72	57		
Bath-unit, field, mobile, 24-show-erhead.						The equipment consists of a boiler with a hinged water back for pre-heating the water, mounted on a two-wheel trailer. A landing wheel is at the front center of the trailer. There is a continuous flow of water at desired temperature at the rate of 1.8 to 2 gallons per minute from each of 24 shower heads.

Chamber, fumigation, methylbromide, nonportable.

4,000

151

85

101

The equipment consists of chamber, non assembly, counter-balance assembly, fan assembly, motor, the injector unit, and the truck assembly. Chamber is designed to withstand and maintain a pressure of 1 lb. per sq. in. 3 lbs. methyl bromide is capable of fumigating 330 cubic feet in 30 minutes.

Chamber, fumigation, methylbromide, portable, gasoline operated.

112

77

74

The equipment consists of six panels which form a boxlike chamber, the injector unit, fan assembly, and the engine. The chamber capacity is the fumigation of 75 to 90 barracks bags of loosely packed clothing, blankets, or other materials in 330 cubic feet of space in about 30 minutes.

Ice cream plant, portable, 2½—  
40 gallon.

79

36

56

The equipment consists of the freezer head, control box, electric motor, heat exchanger strainer and dehydrator, liquid receiver, compressor, storage batteries, fan, condenser, and gasoline engine. The refrigerator will make 2½ gallons of ice cream at one time. Up to 40 gallons can be hardened and stored.

Name	Weight	Shipping dimensions			Remarks	
		Length (in.)	Width (in.)	Height (in.)	Cu. ft.	Sq. ft.
Laundry, mobile, two-trailer type. Laundry, portable, skid-mounted, small-detachment.	418	27½	26	32	11	
Refrigerator, portable, chest-type (25 cubic feet).	3,600	94	38	57		Main parts of refrigeration system are: compressor, compressor shut- off valves, condenser, liquid re- ceiver, dehydrator, filter, heat

exchanger, expansion valve, evaporator plates, pressure control, and thermometer. The net interior volume is 25 cubic feet. The refrigerator is designed primarily for limited storage of frozen foods—for which temperature is held at 10° F. For chilled foods, it is held at 40° F. It is operated by a hand-start gasoline engine and can be operated in transit. Refrigerator may be mounted in a 1 ton cargo trailer or two refrigerators on a 2½ ton truck.

The equipment consists of single needle sewing machine, darning, button machine, hand tack button machine, portable generator, battery, bobbins, machine attachments, lamps, needles, pins, tent, thimbles, yardsticks, etc. Motive power for the trailer is supplied by a 4-5 ton, 4 x 4 tractor-truck, which is attached to trailer by a fifth wheel. The semitrailer has a pay load of six tons. When stationary,

Refrigerator, portable, walk-in, self-contained (150 cubic feet).	20,000	268½	94	132	1,407
Semitrailer, 2-wheel, van-type, clothing repair.					

Name	Weight	Shipping dimensions				Remarks
		Length (in.)	Width (in.)	Height (in.)	Cu. ft.	
Semitrailer, 2-wheel, van-type, laundry.	20,000	209	90	132	-----	<p>the trailer is supported by two dolly wheels and jacks at both forward corners. Interior width is 7½ feet; interior length is 20 feet. There is a door at each end of the trailer and three windows on each side.</p> <p>The equipment consists of a washer, extractor, drying tumblers, hot water heater, boiler, electric generator, cold water pump, hose, fuel tanks, etc. Motive power for the trailer is supplied by a 4-5 ton, 4 x 4 tractor truck, which is attached to trailer by a fifth wheel. The landing gear consists of two leg members to which are attached two dolly wheels. Jacks provide a means of leveling the van. The production rate for a section (2 laundry trailers) is 250 pounds an hour.</p>

**Semitrailer, 2-wheel, van-type,  
repair, textile.**

20,500

270

96

132

The equipment consists of overedge-sewing machine, single needle sewing machine, single needle darning, hand tack button machine, portable generator, battery, bobbins, lamps, needles, pins, setting die for grommets, tent, thimbles, yardsticks, etc. Motive power for the trailer is supplied by a 4-5 ton, 4 x 4 tractor-truck, which is attached to trailer by a fifth wheel. The semitrailer has a pay load of six tons. When stationary, the trailer is supported by two dolly wheels and jacks at both forward corners. Interior width is 7½ feet; interior length is 20 feet. There is a door at each end of the trailer and three windows on each side.

**Semitrailer, 2-wheel, van-type,  
shoe-repair.**

20,400

270

95½

The equipment consists of finishing machine, shoe patching machine, sole cutter and skiver machine, stitching machine, generating set, awl blades, awl haptis, hammers, knives, nippers, pullers, pincers, rasps, nail sets, eyelet and heel removers, shears, work tables, etc. Motive power for the trailer is supplied by a 4-5 ton, 4 x 4 tractor-

Name	Weight Length (in.)	Shipping dimensions Width (in.)	Height (in.)	Cu. ft.	Sq. ft.	Remarks
Semitrailer, 2-wheel, 10-ton refrigerator.	22,150	242	96	129	1,763	164 truck, which is attached to trailer by a fifth wheel. The semitrailer has a pay load of six tons. When stationary, the trailer is supported by two dolly wheels and jacks at both forward corners. Interior width is 7½ feet; interior length is 20 feet. There is a door at each end of the trailer and three windows on each side.  The refrigeration equipment includes compressor, condenser, receiver, expansion valve, and evaporator. Motive power for the trailer is supplied by a 4-5-ton, 4 x 4 tractor-truck, which is attached to trailer by a fifth wheel. The semitrailer has a pay load of five tons. The trailer has a net capacity of approximately 470 cubic feet. Assuming an average weight of 20 pounds per cubic foot, a trailer

may transport 9400 pounds of produce. When such a load is carried, protective slotted racks should be used to prevent items from contacting the refrigerating mechanism.

Semitrailer, 6-ton, 2-wheel, administrative.	21,000	270	95 $\frac{3}{4}$	139	The trailer has a van type body and a pay load of 6 tons. Motive power for the trailer is supplied by a 4-5 ton, 4 x 4 tractor-truck.
Shower unit, field, portable, with heater, 8-showerhead.	4,400	108	67	66	Trailer is identical to two-wheel textile repair trailer, except for repair equipment. The equipment consists of an electric generator, tailoring machine, darning machine, sewing machine motors, sewing machine table tops, folding-type steel frames or stands, double-thread stands, leather drive belts, electric sewing machine lights, folding-type steel chairs, etc. The two-wheel trailer has a
Trailer, 2-wheel, clothing repair...					

Name	Weight	Shipping dimensions					Remarks
		Length (in.)	Width (in.)	Height (in.)	Cir. ft.	Sq. ft.	
Trailer, two-wheel, shoe-repair-----	4,700	108	67	66			<p>pay load of approximately 2,950 pounds. When stationary, it rests on a drawbar support and leveling jacks. The lunette eye of the drawbar is adjustable and can be coupled to any towing vehicle equipped with a standard army pintle hitch.</p> <p>The equipment consists of stitching machine, finishing machine, sole cutter and skiver machine, patching machine, electric generator, etc. The two-wheel trailer has a pay load of approximately 2,950 pounds. When stationary, it rests on a drawbar support and leveling jacks. The lunette eye of the drawbar is adjustable and can be coupled to any towing vehicle equipped with a standard ordnance pintle hitch.</p>

Trailer, two-wheel, textile repair

The equipment consists of darning machine, tailoring machine, textile sewing machines, overedge sewing machines, tack button machine, snap fastener hand set, hand press, sewing machine motors, table tops, folding-type steel frames or stands, double-thread stands, chairs, etc.

The two-wheel trailer has a pay load of approximately 2,880 pounds. When stationary, it rests on a drawbar support and leveling jacks. The lunette eye of the drawbar is adjustable and can be coupled to any towing vehicle equipped with a standard army pintle hitch.

66

67

108

4,400

The equipment consists of a mixing and make-up machinery trailer, proofing and water trailer, two oven trailers, two generator trailers, water pump, sifters, scales, racks, skate-wheel conveyors, tents and tables. Motive power is provided by trucks.

Bakery unit, mobile, M-1945

Mixing & make-up mach. trlr.	11,000	113	88	111
Oven trailer	6,500	193	88	83
Proofing & water trailer				
Flour sifter				

## SECTION V

### PETROLEUM

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#### 20. PETROLEUM PRODUCTS COMMONLY USED IN THEATERS OF OPERATION

A tabulation of all standardized fuels and lubricants that have been approved for procurement and use in army equipment other than aircraft operated by the United States Air Force may be found in SB 38-5-3. The following tabular statement, adapted from that bulletin, provides information on the fuels and lubricants commonly used in theaters of operation:

Product	General use	Symbol
<b>LIQUID FUELS</b>		
<i>1. Gasoline.</i>		
Motor fuel (all-purpose), 80-octane USA 2-103C	For all oversea motor vehicles.	80
Gasoline (unleaded and undyed), 65-octane USA 2-116A	For oversea use in gasoline stoves, gasoline lanterns, etc.	65
<i>2. Burning oils.</i>		
Kerosene FS VV-K-211A	For lanterns and stoves designed to operate on kerosene.	K
<i>3. Fuel oils.</i>		
Oil, fuel, Diesel, 40-octane USA 2-102E	Fuel for Diesel engines (also heating).	D A
Oil, fuel, Diesel, 50-octane NS 7-0-2E	Fuels for high speed Diesel engines.	D A

Product	General use	Symbol
<b>LUBRICATING OILS</b>		
<i>1. Engine oils.</i>		
Oil, engine (SAE 10) USA 2-104B	For lubrication of internal combustion engines, etc.	OE 10
Oil, engine (SAE 30) USA 2-104B	do-----	OE 30
Oil, engine (SAE 50) USA 2-104B	do-----	OE 50
<i>2. Gear lubricants.</i>		
Lubricants, gear, universal (SAE 75) USA 2-105B	For lubrication of all automotive gear units as prescribed (temperature below 0°F.).	GO 75
Lubricants, gear, universal (SAE 90) USA 2-105B	do-----	GO 90
<b>GREASES</b>		
<i>1. Grease, general-purpose, No. 0.</i>	For lubrication of vehicle chassis and other equipment where specified (temperature below 32°F.).	CG 0
USA 2-106		
<i>2. Grease, automotive and industrial.</i>	Lubrication of vehicle chassis and other equipment where specified (temperature above 32°F.).	CG 1
FS VV-G-632 Type A, Grade I		
<i>3. Grease, general-purpose, No. 2.</i>	Wheelbearings and other equipment as specified.	WB
USA 2-108B		
<i>4. Grease, automotive, and industrial.</i>	Water-pump bearings and other points as specified.	WP
FS VV-G-632 Type A, Grade 4		

## 21. CONVERSION TABLE, OIL GASOLINE AND GREASE

From—	To—	Conversion factor
Oil, gallons.....	Pounds.....	7.5
Oil, in drums (short tons).....	Measurement tons.....	.83
Oil tonnage.....	Oil tonnage (in drums).....	1.35
Gasoline, gallons.....	Pounds.....	6.15
Gasoline, pounds.....	Pounds (in drums).....	1.3
Gasoline, gallons.....	Short tons.....	.003075
Gasoline, gallons (in drums). . . . .	do.....	.004
Gasoline, short tons (in drums). . . . .	Measurement tons.....	.7
Gasoline, gallons.....	do.....	.006
Gasoline consumption, estimated by weight.	Oil consumption, estimated by weight.	.025
Gasoline consumption, estimated by weight.	Grease consumption, estimated by weight.	.002
Grease, short tons.....	Grease, measurement tons.	1
Fuel, aviation, 1 gallon....	42-gallon barrels (in bulk).	.0238
Fuel, aviation, 1 gallon....	55-gallon drums (53 gallons).	<sup>1</sup> .004 <sup>2</sup> .0036 <sup>3</sup> .006

<sup>1</sup> Short tons.

<sup>2</sup> Long tons.

<sup>3</sup> Measurement tons.

## 22. GASOLINE EQUIVALENTS

Quantity	Per gallon	Per barrel	Per drum	Per pound	Per short ton
Gallons	-----	42	53	0.1626	325.2
Barrels	0.02381	-----	1.31	.00387	7.7429
Drums	.01818	.76374	-----	.002956	5.9127
Pounds	6.15	258.3	338.25*	-----	2000
Tons	.003075	.12915*	.16913	.0005	-----

\*Does not include weight of container.

## 23. ESTIMATE OF REQUIREMENTS

Methods of computation are as follows:

*a. Per man per day method.*

- (1) The per man per day method of computation is used in the early planning stages when definite information is not available on the number and types of vehicles. It is to be used as a guide only and not as a substitute for a more exact computation. Since the figures derived from this method vary with the situation, no established maintenance factors can be used that may apply to all types of operations.
- (2) The following table, which is the estimated average daily expenditure of the class III supplies (except Polar theater of operations) may be used as an over-all basis for considering the requirements of ground, air, and service operations:

Item—class III	Pounds per man per day	Tons per man per day	Conversion factors short to measurement tons	Measurement tons per man per month	Measurement tons per man per month with 15 percent stowage
Gas, oil, grease (less AF).	11.4	0.174	1.5	0.261	.300
AF fuel and lubricants.	12.0	.179	1.5	.269	.309
Subtotal.	23.4	.353	-----	.530	.609
Less 90 percent assumed shipped by tanker.	21.06	.318	-----	.477	.548
Shipped as dry cargo.	2.34	.035	-----	.053	.061
Fuel for temperate zone.	8.50	.128	2.0	.256	.294
Total class III.	31.90	.478	-----	.786	.903

*b. Per vehicle per day method.* In deciding upon the POL requirements for a specific operation, it is necessary to know the number and types of vehicles and organizations. It is necessary also to know the average consumption rate per mile and the average operating mileage per day.

*c. Unit method.* The unit method, which is more or less a combination of the per man per day and the per vehicle per day method, is based primarily on the units involved, the estimated movement, and the location of dumps, together with the quantity of supplies at the dumps.

## **24. FACTORS CONTROLLING GASOLINE REQUIREMENTS**

The main factors controlling the gasoline requirements of motor vehicles in military operations are—

*a. Distance of movement.* By measuring the distance the center of an organization is displaced, one can find how many miles each vehicle in an organization will have to move.

*b. Gallons of fuel per mile.* The number of gallons of gasoline required to move the vehicles a given distance will have to be known. (If no estimates are available, an estimate of 6 gallons per wheeled vehicle per day and 50 gallons per track-laying vehicle per day can be used.)

*c. Distance of supply point.* Under certain conditions, certain vehicles will have to go to supply points. In this event, requirements for average round-trip distances must be used. Since only 2/10 of the vehicles will make this trip, the estimated requirements of the supply vehicles may be obtained by multiplying the distance moved by the organization by the number of gallons required to move the organization and taking 2/10 of the result.

*d. Variables.* Consideration must also be given to fuel needs for warming up engines, and for movement within the bivouac areas and on reconnaissance. Under average conditions, gasoline sufficient to move every vehicle in the organization 10 miles will be required for these variables.

*e. Other factors.*

- (1) In the combat zone, 10 percent should be added to consumption figures obtained from gasoline supply data tables in order to de-

termine the gross requirements. This addition covers evaporation, spillage, and small combat losses in the forward area.

(2) Vehicles used in amphibious assault operations are combat-loaded aboard ships and craft, with fuel tanks  $\frac{3}{4}$  full, and carry 10 gallons of reserve fuel in 5-gallon expeditionary containers. An additional supply is generally combat-loaded in the assault convoy and in the supply convoy.

## 25. USE OF EXPERIENCE TABLES

a. Performance figures from experience tables are useful in determining class III requirements. Weekly requirements can be calculated by such figures and by maintaining close liaison with G-3. Estimates for each succeeding week are prepared for the requisite amounts. An allowance for 5-percent increase in tonnage is generally made for auxiliary equipment, such as ranges and generators. Allowances for lubricants can be made on a percentage basis established from experience.

b. When the gallons per mile (unit mile) required for any specific vehicle are known, it is possible to compute the requirements for operations in progress or projected. For example, a 7-day supply may be computed in the following manner:

Vehicles		Unit mile	Gasoline requirements (gallons)	
No.	Type		1 day (50 miles)	7 days
4	Light tank M24	.63	0.63 x 4 x 50—126	882
2	Medium tank M4A4	1.25	1.25 x 2 x 50—125	875
6	Half track	.30	0.30 x 6 x 50—90	630
8	1/4-ton	.069	0.069 x 8 x 50—27.6	193.2
5	2½-ton	.212	0.212 x 5 x 50—53	371

c. A specific table can be developed from any performance record. An example of such a table is the following:

Number of vehicles	Consumption per veh. per day	Total consumption per day	Total quantity on hand	Days of supply
--------------------	------------------------------	---------------------------	------------------------	----------------

- (1) Column 4 divided by column 3 gives column 5.
- (2) Column 3 divided by column 1 gives column 2.

## 26. CLASS III REQUIREMENTS FOR AMPHIBIOUS OPERATION

The following methods of arriving at class III requirements and making storage computations are taken from quartermaster reports of an amphibious operation in Europe. The computations may serve to illustrate the principles of estimates discussed in paragraph 25.

Type of vehicle	Miles per gallons	Type of gas	No. of vehicles	Gallons per 100-mile day	10-day supply (gal.)
Tank type	1	V80-octane	1,629	162,900	1,629,000
Half track	3	-----do-----	1,580	52,700	527,000
Auto units	8	-----do-----	27,270	340,875	3,408,750
					5,564,750

(1)

Number of 5-gallon cans of gasoline -----	1,112,950
Total weight (40 lb. per can) of gasoline -----	44,518,000
Number of long tons of gasoline -----	19,428

(2)

Lubricating oil (5 percent of fuel requirements in gallons) -----	278,238
Gear lubricant (7 percent to 10 percent of fuel requirements in gallons) -----	556,475
Number of 5-gallon cans of lubricating oil and gear lubricant -----	166,943
Weight of same at 45 pounds per can -----	7,512,435
Grease (2 percent of requirements in gallons but expressed in pounds). -----	111,295
Total weight of lubricating oil, gear lubricant, and grease -----	7,623,730
Number of long tons of same -----	3,403

(3)

Total number of long tons of gasoline, lubricating oil, gear lubricant, and grease -----	22,831
--	--------

(4)

Number of cubic feet of shipping space (at 110 cubic feet per long ton) required for gasoline, lubricating oil, gear lubricant, and grease, including allowance for broken storage -----	2,511,423
--	-----------

(5)

Actual number of cubic feet (at 51 cubic feet per long ton) required for gasoline, lubricating oil and gear lubricant in 5-gallon cans ----- 1,164,381

(6)

Each motor vehicle will carry ashore a tank full of gasoline and enough gasoline in 5-gallon cans for 24 hours' operation.

(7)

Due to the necessity of having an adequate supply of gasoline and lubricants available for immediate use in the early stages of the operation, it would be essential, and most desirable, to transport, the gasoline and lubricants, equally divided, on at least three or more, preferably six, ships so that unloading could be carried on simultaneously at different docks and that, in the event of destruction of one or more ships, the remaining ships would deliver a supply of gasoline and lubricants for the initial operation.

## 27. SPACE REQUIREMENTS FOR A CLASS III DEPOT

The following plan, based on quartermaster reports of operations in Europe, may be considered in arranging the layout of a class III depot:

Type of vehicle	Miles per gallon	Type of gas	No. of vehicles	Gallons per 100-mile day	10-day supply (gal.)
Tank type	1	V80-octane	1,629	162,900	1,629,000
Half track	3	----do----	1,580	52,700	527,000
Auto units	8	----do----	27,270	340,875	3,408,750
					5,564,750

## (1)

Number of 5-gallon cans of gasoline	1,112,950
Number of stacks (100 cans per stack) of gasoline line	11,130

## (2)

Lubricating oil (3 percent of fuel requirements in gallons)	166,942
Gear lubricant (1 percent of fuel requirements in gallons)	55,648
Grease (1 percent of fuel requirements in gallons but expressed in pounds)	55,648

*Note.* The type of engine oil to be stocked will depend on age of vehicles and on climatic conditions.

## (3)

Placing the stacks 40 yards apart for safety purposes will require 400 sq. yd. per stack in open storage. On this basis the following open storage space (sq. yd.) will be required.

(a) For gasoline	4,452,000
(b) For lubricating oil (3 percent fuel)	133,560
(c) For gear lubricant (1 percent fuel)	44,520
(d) For grease (1 percent fuel)	44,520
	4,674,600

## (4)

In arrangement of the stacks, advantage should be taken of all available natural camouflage, which might necessitate placing some stacks more than 40 yards apart. Inadequate natural camouflage would necessitate cutting brush or obtaining net or other camouflage from the Corps of Engineers.

## (5)

In the event of wide dispersion of large units, which railroads or road nets might make necessary or desirable, it might be desirable to establish two or more smaller depots instead of one large depot.

## 28. DIMENSIONS OF STANDARD POL CONTAINERS

Nomenclature	Units in package	Type of package	Size of package (inches)		
			L	W or Diam.	H
U. S. 55-gallon drum, 16 gage.	1	Drum	0	24 $\frac{1}{8}$	34 $\frac{3}{4}$
U. S. 55-gallon drum, 18 gage.	1	...do...	0	24 $\frac{5}{8}$	34 $\frac{7}{8}$
U.S. 5-gallon can (gasoline) -	1	Can ..	13 $\frac{3}{4}$	6 $\frac{1}{2}$	18 $\frac{3}{8}$
U. S. 5-gallon can (oil)-----	2	Case ..	0	11 $\frac{15}{16}$	14 $\frac{3}{16}$
U. S. 5-quart can (oil) .....	6	...do..	22	14	10
U. S. 1-quart can (oil)-----	12	...do..	18	13	6
U. S. 25-pound pail (grease) -	1	Pail ..	0	11 $\frac{1}{2}$	11 $\frac{1}{2}$

## 29. WEIGHTS, VOLUMES, AND CONVERSION FACTORS

Product	Packaging	Weight (lb.)	Cubic feet			Conversion factors			Gal. <sup>1</sup> per short ton	Gal. <sup>1</sup> per meas. ton	Bbl. <sup>1</sup> per long ton	Pac- kages per meas. ton	Pac- kages per long ton
			Actual	Planning factor	Gal. to lb.	Lb. to gal.	Gal. per short ton						
Aviation gasoline.	Bulk												
	55-gal drums <sup>2</sup>	339	11.2	12	5.91	0.168	385	376	8.93				
	5-gal drums	41.1	.95	1						177		5.57	6.24
										200		48.7	54.5
80-octane gasoline.	Bulk												
	55-gal drums <sup>2</sup>	378	11.2	12	6.14	.163	326	365	8.69				
	5-gal drums	41.9	.95	1						177		5.29	5.93
										200		47.7	53.5
Kerosene	Bulk												
	55-gal drums <sup>2</sup>	407	11.2	12	6.80	.147	294	330	7.86				
	5-gal drums	45.2	.95	1						177		4.91	5.50
										200		44.2	49.6
Diesel fuel.	Bulk												
	55-gal drums <sup>2</sup>	423	11.2	12	6.99	.143	286	320	7.62				
	5-gal drums	46.2	.95	1						177		4.73	5.30
										200		43.3	48.5

Lubricating oils.	Bulk:								
55-gal drums <sup>2</sup>	455	11.2	12	.60	.132	263	295	177	7.02
5-gal drums <sup>3</sup>	49.2	.95	1	8.70	.115	280	-	200	4.40
1-qt cans (12 per case).	34.5	.88	1	9.76	.103	205	-	-	4.92
1-qt cans (24 per case).	60	1.6	2	-	-	-	-	58.0	3.33
5-qt cans (6 per case).	77	1.9	2	-	-	-	-	-	45.5
Greases.	Bulk:								
25-lb pails	29	.95	1	-	-	-	-	69.0	40.0
5-lb cans (6 per case).	44	1.1	2	-	-	-	-	45.4	40.0
								50.9	20.0

<sup>1</sup> For ocean shipping, storage, and pipeline computation, bulk petroleum products are usually measured in barrels of 42 gallons each, or in long tons.

<sup>2</sup> Drums, 55-gallon, are normally filled to 53 gallons to allow for expansion. Drums, 18-gage weight approximately 51 pounds empty.

<sup>3</sup> For planning purposes weight of gasoline may be taken as 42 pounds and weight of lubricating oil for motors as 50 pounds per 5-gallon drums, including weight of the drum. Drums, 5-gallon weigh approximately 11 pounds empty.

## 30. COLLAPSIBLE CONTAINERS

*a. General.* The collapsible containers or cells, which are made of synthetic-rubber impregnated fabric, are manufactured in the following types and capacities:

- (1) *Type 1.* Type 1 containers are nonrigid containers of 1,000- and 3,000-gallon capacity each. They are supported inside a canvas housing and rest on a canvas ground cloth.
- (2) *Type 2.* Type 2 containers are rigid containers of 750- and 2,700-gallon capacity each. They are supported inside a plywood housing and may be used for the storage and transportation of liquid fuels.

*b. Uses.* Collapsible containers are most useful when shipping space is limited and where short time storage is anticipated. They may be set up singly or connected in banks to a central or main line. The 750-gallon containers, when erected and filled, may be transported on a 2½-ton truck. Three 2,700-gallon containers may be placed lengthwise on a flatcar used to transport petroleum products. The containers and accessories are packed by the manufacturer in plywood boxes. These boxes should be retained.

*c. Dimensions and other data.*

Gallonage	No. of cases	Dimensions of cases	Weight	Cubage
1.000...	1	92 $\frac{1}{4}$ x 32 $\frac{1}{4}$ x 16 $\frac{1}{4}$ "--	400	28.0
3.000...	1	142 $\frac{1}{4}$ x 47 $\frac{1}{4}$ x 12 $\frac{1}{4}$ "--	751	47.6
	(1)	81 $\frac{1}{4}$ x 18 $\frac{1}{4}$ x 42 $\frac{1}{4}$ "--	268	36.3
	(2)	63 x 60 $\frac{5}{8}$ x 11"--	365	24.3
750-----	(3)	99 $\frac{1}{2}$ x 16 $\frac{3}{4}$ x 12 $\frac{3}{4}$ "--	365	12.3
	(4)	25 $\frac{5}{8}$ x 13 $\frac{5}{8}$ x 15 $\frac{7}{8}$ "--	132	3.21
	Total 4	-----	1,130	76.11
	(1)	94 $\frac{5}{8}$ x 93 $\frac{1}{4}$ x 9 $\frac{1}{4}$ "--	650	47.23
	(2)	94 $\frac{5}{8}$ x 93 $\frac{1}{4}$ x 9 $\frac{1}{4}$ "--	650	47.23
	(3)	131 $\frac{1}{4}$ x 10 $\frac{1}{4}$ x 7 $\frac{1}{4}$ "--	300	5.66
2.700---	(4)	70 x 65 $\frac{1}{4}$ x 22 $\frac{1}{4}$ "--	441	58.8
	(5)	123 $\frac{3}{4}$ x 26 $\frac{3}{4}$ x 12"--	525	22.9
	(6)	35 $\frac{1}{8}$ x 17 $\frac{5}{8}$ x 15 $\frac{7}{8}$ "--	174	5.67
	Total 6	-----	2,740	187.49

### 31. STORAGE TANKS

*a. General.* Storage at terminals or loading locations normally will be in bolted steel tanks ranging in capacity from 100 to 10,000 barrels (42 U. S. gallons equal 1 barrel). Pressure and vacuum-release valves are supplied with all sizes of tanks.

*b. Capacities and other data.*

Type of tank	Gallons	Barrels	Weight (pounds, empty)	Cubic feet (packed)
Steel, bolted.....	420,000	10,000	74,000	2,015
Do.....	210,000	5,000	43,000	890
Do.....	42,000	1,000	12,795	292
Do.....	21,000	500	7,360	218
Do.....	10,500	250	4,900	144
Do.....	4,200	100	2,250	80

## 32. DISPENSERS

Dispensers are used for decanting gasoline, Diesel oil, and all other nonviscous POL products.

*a.* The 30-gallon-per-minute dispenser is a small portable unit mounted on a tubular frame and weighs approximately 300 pounds. It can be transported in either a cargo vehicle or a trailer or can be carried by two men. The suction hose is 30 feet long. It has one 20-foot length of discharge hose equipped with a Y-coupling providing two 10-foot lengths, each equipped with a nozzle.

*b.* The 100-gallon-per-minute dispenser is skid-mounted, weighs about 2,000 pounds, and is usually carried on a 1-ton trailer. It has four 25-foot lengths of suction hose and four 75-foot lengths of discharge hose, each equipped with Y-couplings providing two 10-foot lengths, each equipped with a nozzle.

### **33. TRANSPORTATION, RAIL AND MOTOR**

#### *a. Rail.*

- (1) Tank cars, when available, are used to move petroleum. The cars are metal cylindrical tanks varying in capacity from 6,000 to 13,000 gallons. They have a manhole through which they are loaded and an outlet valve through which they are unloaded. Tank cars used for shipping one kind of petroleum products should be thoroughly cleaned before they are used for another kind. The U. S. Army 40-ton tank car has a nominal capacity of 9,900 U. S. gallons. The safety valves are set at 25 pounds per square inch.
- (2) The dimensions of an average U. S. railway boxcar are 50 feet long, 10 feet high, and 8 feet wide. Its average capacity is 50 short tons and it can transport 1,700 filled or 3,200 empty 5-gallon containers, 175 filled or 300 empty 55-gallon drums.

#### *b. Motor.*

- (1) *General.* There are various types and sizes of tank trucks and trailers used to transport petroleum products. Among those most widely used are the 750-gallon truck and the 2,000-gallon semi-trailer. Skid tanks of 750-gallon capacity may also be used. Two of these can be mounted on a 1-foot-bed, cargo-body, 2½-ton 6 x 6 truck to provide a 1,500 gallon carrying capacity.

(2) Standard types and capacities of trucks and trailers.

Type of container	Unit pack	Cases or units per load*			
		1-ton trailer (capacity)	2½-ton cargo (capacity)	5-ton cargo (average)	10-ton semitrailer (average)
<i>Full</i>					
U. S. 55-gallon drum.	1	6	15	24	49
U. S. 5-gallon can (gasoline).	1	50	125	250	500
U. S. 1-quart can (oil).	12	60	145	290	581
U. S. 25-pound pail (grease).	1	70	170	245	690
<i>Empty</i>					
U. S. 55-gallon drum.	1	6	23	23	55
U. S. 5-gallon can (gasoline).	1	88	320	320	750

\* When overloads are authorized, these quantities may be increased to the cubic capacity of the vehicles or to 100 percent overload, whichever limit is reached first.

### 34. PIPE LINES

Portable military pipe lines are a rapid and comparatively safe method of moving large quantities of petroleum over rough terrain. They relieve congested road traffic and are quickly installed. The 4-inch pipe line has a capacity of 200 barrels (or 8,400 gallons) an hour; the 6-inch has a capacity of 400 barrels (or 16,800 gallons) an hour. The lines come in standard 20-foot sections. One of these

sections, equipped with pressure reducers and attachments for hose, may be used as an outlet to form emergency filling stations for vehicles. Pipe lines may be used for—

- a. Transportation of petroleum over terrain too rugged for other means of transportation.
- b. Relief of congestion where road capacity is limited.
- c. Rapid transportation of petroleum over long distances.
- d. Transportation of petroleum over short distances where enemy action makes other means of transportation impracticable.

### 35. AIR

Petroleum products may be transported by air. See section IX, paragraph 61.

## SECTION VI

### WAREHOUSING

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#### 36. SPACE LAYOUT

In the determination of space layout for a storage area, both commodity and capacity factors will be taken into account.

*a. Commodity factors.* Commodity factors concern the supplies themselves. Active supplies must be stored near doors and loading points. Supplies in quantity should have large blocks of space provided in center or end bays, where maximum stacking height may be obtained. Small quantities may be placed in different parts of the storage area. The size, weight, and shape of the supplies must be considered in space planning so that heavy or bulky items will have a shorter distance to travel between stock and loading point than supplies that are light and easy to handle. Space should be planned in such a way that supplies which need special consideration may be given proper storage.

*b. Capacity factors.* Capacity factors concern the storage area itself—its physical characteristics and the use of floor or ground area and space from there upward. Space will be planned so that every foot of floor or ground space may be utilized. Vertical storage space is just as valuable as an equal amount of horizontal space. It is wasted when supplies are not stacked high.

## 37. AISLES ARRANGEMENT

a. *General.* A warehouse aisle is a passageway along which supplies and materials-handling equipment may be moved. Whenever possible, aisles should be laid out with reference to the location of doors. There are two primary types of warehouse aisles:

- (1) *Transportation aisles.* Transportation aisles provide access to the loading platform and to the supplies in storage. They also provide for traffic and operation of equipment. They should run in the direction of the heaviest traffic, and a sufficient number of them should be used so that no other aisles will be necessary. There are two types of transportation aisles:
  - (a) *Main aisles.* Main aisles should be wide enough to permit easy passing of two loaded pieces of materials-handling equipment going in opposite direction. Main aisles of 10-foot width, accommodating a 4,000-pound-capacity fork lift truck, are ample for the average warehouse.
  - (b) *Cross aisles.* Cross aisles run at right angles to the main aisles, which they connect. Wherever possible, they should lead directly to the loading platforms. They should be 9 to 10 feet wide and should be laid out so that there will be a 30- to 45-foot depth of storage.
- (2) *Fire aisles.* Fire aisles will be arranged in accordance with Department of the Army

directives pertaining to fire regulations. They should not be obstructed. Portable fire-fighting equipment should be placed in readily accessible locations, beside doors and columns at transportation aisles, and at fire wall entrances.

*b. Planning aisle arrangements.* In planning aisle arrangement consider the following:

- (1) Location of loading and unloading platforms.
- (2) Arrangement of posts or columns for floor or roof support.
- (3) Size and types of materials-handling equipment.
- (4) Methods of storage.
- (5) Light facilities.
- (6) Dimensions and weights of supplies.

## 38. SPACE REQUIREMENTS

*a. Closed storage.*

- (1) An ideal closed-in warehouse is used as the basis for computing the number of square feet required for storing quartermaster supplies. From this ideal number allowances can be made for storage in buildings not designed as warehouses, for storage in the open, and so on. Factors to be used in computing ideal storage space are—
  - (a) Weights and cubic measurements of all T/E and T/O & E items of equipment required for a model stock.
  - (b) Amount of net space required for storage of supplies.

- (c) Amount of space consumed by aisles; fire aisles; obstructions, such as posts and unusable corners in the warehouse; sorting space, etc.
- (d) Floor load capacity and height of stacks based on floor load or handling equipment.

(2) The net space required to store all items of a model stock for a given number of men is computed and reduced to the number of pounds per man per day for each class or group of items. From this per man figure storage requirements for any number of men can be computed.

(3) The average net usable space in any warehouse may be estimated roughly as 60 percent of the total gross space. This leaves roughly 24 percent for aisles, lost space, etc. and an additional 16 percent as a safety factor. Note that this statement is consistent with the requirement that, to get the gross space needed, 40 percent should be added to the net square feet of storage space required. In this latter rule the added safety factor is not present.

*b. Open storage.*

- (1) *General.* The principal factors involved in computation of open storage space are dispersion and the use of tentage, paulins, or dunnage.
- (2) *Dispersion.*
  - (a) *Ratio of storage to dispersion.* The ratio of storage space to dispersion space is 1 to 40, subject to the following con-

ditions: nature of the supplies, danger of enemy attack, terrain, and the effect of dispersion on the efficiency of dump operations. Thus, 1 square foot of gross storage space usually requires 40 square feet of dispersion space.

(b) *Dispersion acreage.* Since the approximate number of square feet per acre is 40,000, the dispersion acreage may be obtained by multiplying the number of square feet of gross storage space by 40 and dividing the product by 40,000. (The same result may be obtained more readily by simply dividing the number of square feet of gross storage space by 1,000.).

c. *Storage space requirements.* The following will serve as a guide for computing the storage space required to maintain any given number of men:

*Gross Storage Requirements\* (Square Feet)  
in Theater of Operations*

Class	Per man per day			
	Closed	Open	Refrig.	Total
A ration-----	0.0556	0.0415	0.0264	0.1235
C & E-----	.0146	.0019	0	.0165
Regular supplies-----	.0014	.0007	0	.0021
B ration-----	.0329	.0493	0	.0822
C-2, C-3, and C-4 ration	0	.0298	0	.0298
5-in-1 ration (A or B)-----	0	.0274	0	.0274
Individual assault food packet.	0	.0085	0	.0085

\* Requirements are based on experience in the European theater of operations and allow for 8 feet stacks and 40 percent unusable space. Requirements do not include the dispersion factor for setting up storage tents in open fields.

## **39. DETERMINING SQUARE FOOT ALLOCATION**

To determine the number of square feet of floor space required to store 1 ton, divide the weight in pounds per ton by the allowable floor load. To determine the total number of square feet required, multiply the number of tons of supplies to be stored by the square feet per ton. For example, assume that the floor load allowed per long ton of supplies is 250 pounds per square foot. Then the approximate net storage space required per ton is 9 square feet ( $2,240 \div 250$ ). The total number of square feet of storage space for 40 tons (assumed) would be 360 ( $40 \times 9$ ).

## **40 DETERMINING MAXIMUM STACKING HEIGHT**

Assume that certain supplies (40 tons) consist of 50-pound boxes and that each box occupies 3.5 square feet of floor space, 250 pounds per square foot being the allowable floor load. Then the load per square foot is approximately 14 pounds ( $50 \div 3.5$ ). The approximate number of boxes to be stored in one column would be 17 ( $250 \div 14.3$ ).

## **41. FLOOR LOADING**

a. Safe warehouse floor loads are normally determined by reference to the building plans on which the floor capacities in pounds per square foot are usually designated. In all cases where building plans are not available or where the plans do not indicate safe floor loads, or where the accuracy of the stated floor loads is doubtful, a competent en-

gineer must be brought in to establish floor load capacity.

b. Loading on floors should be distributed so that the weight bearing on any single square foot does not exceed the load capacity of that square foot. Thus, a warehouse bay defined by columns 16 feet apart, with a safe load capacity of 250 pounds per square foot, may be evenly loaded to a total of 64,000 pounds ( $16 \times 16 \times 250$ ).

c. In certain instances, overloading of portions of a floor area to compensate for adjacent vacant or underloaded portions is permissible and is recommended whenever space is at a premium. The following may be used as a guide to safe overloading:

- (1) In wood frame construction, where the normal storage space of a floor area is reduced by narrow aisles, the remaining storage space may be overloaded by an amount equal to the capacity of the aisles, provided that the aisle runs perpendicular to the floor support and that the excess load is uniformly distributed over the remaining portion of the bay. For example, a 16- by 16-foot bay whose safe floor capacity is 250 pounds per square foot can be loaded to a total of 64,000 pounds. A fire aisle 2 feet wide running the full length of the bay would reduce the storage space by 32 square feet, leaving a remaining area of 224 square feet for storage. Provided that this aisle runs perpendicular to the floor supports, the remaining area could safely be loaded at the uniform rate of 64,000 divided by 224 or approximately 285 pounds

per square foot. When the aisle runs parallel to the floor supports or is used for the transportation of supplies or the movement of mechanical equipment, compensation will not be made and the remaining space in the bay will not be loaded beyond the rated space capacity.

- (2) In wood frame construction, when a bay is to be loaded unequally, it can normally be stored to its full capacity, provided that no part is overloaded in excess of 20 percent and that the dividing line of the unequal loading is perpendicular to the floor support—that is to say, that the floor joists run out from the underloaded portion and through the overloaded portion. For example, a 16- by 16-foot bay with a total safe load capacity of 64,000 pounds may be loaded on the side of a line perpendicular to the floor joists with 38,400 pounds of supplies and on the other side with 25,600 pounds. If the dividing line of unequal loading runs parallel to the floor support, the maximum load per square foot may not exceed the rated safe load.
- (3) In reinforced concrete flat slat construction, where a portion of the floor is not loaded in order to provide aisle space or for other reasons, the remaining portion of the floor can sustain an overload, provided it does not exceed  $33\frac{1}{3}$  percent over any appreciable portion of the floor.

*d.* The maximum capacity of fork lift trucks

which may be safely operated on a warehouse floor of a given live load can be determined as follows:

- (1) Floors having a safe live load capacity of 250 pounds per square foot will in general support with safety the operation of loaded fork lift trucks whose capacity does not exceed 4,000 pounds. The floor space adjacent to aisles over which the trucks travel will not be loaded beyond its rated safety load and no other concentrated loads will be permitted in aisles when the trucks are operating.
- (2) Fork lift trucks exceeding 4,000-pound capacity will be divided into two classes in determining floor safety for their operation. First, trucks having close spacing of wheels or tricycle arrangement of wheels, or narrow-gage tracks with short wheelbase, require that each individual floor be analyzed to determine whether the trucks can operate safely. Second, trucks having a gage of 3 feet or greater and a wheelbase of 5 feet or greater may operate safely in reinforced concrete buildings or steel frame buildings with reinforced concrete floor slabs, on floors designed for 350 pounds per square foot or where the framing can support a concentrated load of 2,500 pounds distributed over an area 2.5 feet square.
- (3) An allowance for impact of 15 percent of the total truck load will be added in all computations for determining safe loads on floors.

## 42. TYPES AND SIZES OF PAULINS

*a. Canvas.* Canvas paulins are normally provided in two sizes—12 by 17 feet and 17 by 40 feet; however, various other sizes are in use. Consideration must be given to the sizes of paulins available before determining the size of the stacks to be made. Canvas paulins are much more convenient to use. Due to their strength they may be pulled over the stack without too great a hazard of tearing, and there is less possibility of their ripping and tearing loose because of wind. Canvas paulins are not expendable.

*b. Paper.* Brown-skin or paper paulins are most commonly procured in size 15 by 60 feet. Actually this size is made up of five 3- by 60-foot sections sewn together with overlapping seams. Various other sizes may be procured or cut by the using agency. Brown-skin or paper paulins have the advantage of being much lighter than other covers, but care must be taken to place them rather than pull them over the stack. Paper paulins require more care in lashing to eliminate the possibility of tearing by the wind. If the paper paulin is creped in one direction and crimped in the other, it will withstand long exposure without separation of the paper from the asphalt bond. The crepe in the paper takes up the shrinkage as the material weathers. Paper paulins are expendable and may be shipped with the item.

## 43. MATERIALS HANDLING EQUIPMENT

### a. Fork lift trucks.

#### (1) General.

##### (a) Description.

1. The fork lift trucks is a four-wheel automotive unit which enables one man to pick up a unit load, carry it to its destination, and stack it. The load is carried in front of the truck on a two-tined fork, which is moved vertically on a supporting frame by either a mechanical or hydraulic lift mechanism. The supporting frame and the fork can be tilted forward from the vertical to pick up the load and backward from the vertical to aid in balancing the lifted load. The weight of the load in front of the truck cannot exceed the amount of the vehicle's weight which falls behind the "center of driving" wheels.
2. Fork lift truck capacity is rated upon the weight of the load that can be carried and the height that the load can be lifted. For interior warehouse duty, the fork lift truck is commonly equipped with solid rubber tires. For outdoor use, pneumatic tires are provided to traverse uneven ground. Models used outdoors can be considerably larger and, therefore, have greater carrying capacities than those used indoors.

3. The fork lift truck may be powered by a gasoline engine, a battery-electric motor, or a gas-electric power unit. The brake system is either hydraulic or mechanical. Either automobile-type steering or lever-type steering may be found in the fork lift truck, but the automobile-type is the more common.

(b) *Use.*

1. The extreme flexibility of the fork lift truck is its primary advantage. The most successful and efficient use of the fork lift truck is in handling palletized unit loads of 2,000 pounds or more. However, it is often used to move items which, because of their size or shape, cannot be palletized.
2. In performing high unit-load storage, the fork lift truck utilizes maximum cubic space, simplifies inventories and inspections, and permits rapid relocation of supplies. To make the most of the versatility of the fork lift truck, it should be used in conjunction with a tractor-trailer train whenever the horizontal distance the load to be carried is 250 feet or more.
3. The use of gasoline or electric power in the fork lift truck depends upon the requirements of a particular storage situation. Relative advantages must be considered in choosing a truck for a specific job.

(2) *Types and capacities.*

*Fork Lift Trucks*

Capacity (lbs.)	Height lift (in.)	Type tires	Gas or electric
2,000-----	48	Solid-----	Electric.
2,000-----	60	-----do-----	Do.
2,000-----	105	-----do-----	Do.
2,000-----	108	-----do-----	Do.
2,000-----	120	-----do-----	Do.
2,000-----	129	-----do-----	Do.
2,000-----	155	-----do-----	Do.
3,000-----	57	-----do-----	Do.
3,000-----	108	-----do-----	Do.
3,000-----	119	-----do-----	Do.
3,000-----	144	-----do-----	Do.
4,000-----	72	-----do-----	Do.
4,000-----	104	-----do-----	Do.
4,000-----	108	-----do-----	Do.
4,000-----	119	-----do-----	Do.
4,000-----	125	-----do-----	Do.
4,000-----	144	-----do-----	Do.
4,000-----	168	-----do-----	Do.
5,000-----	72	-----do-----	Do.
5,000-----	105	-----do-----	Do.
6,000-----	59	-----do-----	Do.
6,000-----	104	-----do-----	Do.
6,000-----	119	-----do-----	Do.
6,000-----	125	-----do-----	Do.
6,000-----	144	-----do-----	Do.
6,000-----	168	-----do-----	Do.
7,000-----	119	-----do-----	Do.
8,000-----	119	-----do-----	Do.
2,000-----	60	-----do-----	Do.
2,000-----	68	-----do-----	Gas.
2,000-----	72	-----do-----	Do.
2,000-----	98	-----do-----	Do.
2,000-----	108	-----do-----	Do.
2,000-----	144	-----do-----	Do.
2,000-----	168	-----do-----	Do.

Capacity (lbs.)	Height lift (in.)	Type tires	Gas or electric
3,000-----	60	Solid-----	Gas.
3,000-----	72	-----do-----	Do.
3,000-----	84	-----do-----	Do.
3,000-----	96	-----do-----	Do.
3,000-----	104	-----do-----	Do.
3,000-----	108	-----do-----	Do.
3,000-----	144	-----do-----	Do.
3,500-----	60	-----do-----	Do.
3,500-----	108	-----do-----	Do.
3,500-----	144	7-ply pneu- matic.	Do.
4,000-----	60	Solid-----	Do.
4,000-----	72	-----do-----	Do.
4,000-----	84	-----do-----	Do.
4,000-----	108	-----do-----	Do.
4,000-----	144	-----do-----	Do.
4,000-----	168	10-ply pneu- matic.	Do.
5,000-----	104	Solid-----	Do.
5,000-----	114	-----do-----	Do.
5,000-----	126	-----do-----	Do.
5,000-----	144	-----do-----	Do.
6,000-----	60	-----do-----	Do.
6,000-----	72	-----do-----	Do.
6,000-----	104	-----do-----	Do.
6,000-----	108	-----do-----	Do.
6,000-----	120	10-ply pneu- matic.	Do.
6,000-----	126	Solid-----	Do.
6,000-----	144	-----do-----	Do.
6,000-----	168	-----do-----	Do.
7,000-----	104	-----do-----	Do.
7,000-----	108	-----do-----	Do.
7,000-----	144	-----do-----	Do.
7,000-----	168	-----do-----	Do.
7,500-----	144	-----do-----	Do.
10,000-----	74	-----do-----	Do.

Capacity (lbs.)	Height lift (in.)	Type tires	Gas or electric
10,000-----	120	10-ply pneumatic.	Gas.
10,000-----	210	12-ply pneumatic.	Do.
12,000-----	120	Solid-----	Do.
12,000-----	210	-----do-----	Do.
14,000-----	120	-----do-----	Do.
15,000-----	120	-----do-----	Do.
15,000-----	144	12-ply pneumatic.	Do.
15,000-----	210	Do.	Do.

*b. Platform trucks.*

(1) *General.*

(a) *Description.*

1. The platform truck is a self-propelled, power-operated vehicle designed to lift, transport, and set down loads mounted on skids. The load platform is supported by the entire wheel base.
2. There are three types of platform trucks, with varying load capacities. The simplest type is a load carrier with a stationary platform. This truck cannot load itself, so it can be used only for transporting materials.
3. In the second type of platform truck, the platform may be raised slightly above its resting position. That elevation is sufficient to make this type self-loading when used with a skid.

4. The third, and most useful, type of platform truck is equipped with a high-lift platform. At rest, the platform is supported by the bed frame of the truck, but it can be raised high on vertical masts erected at the rear of the platform. This truck loads itself, transports the load, and lifts the load high enough to stack it in storage.
5. The platform truck may be powered by a gasoline engine, a battery-electric motor, or a gas-electric power unit. The braking system is usually mechanical, but hydraulic brakes appear occasionally in some of the larger models. Either automobile-type or lever-type steering may be used.

(b) *Use.*

1. The platform truck is used primarily to transport unit loads from one place to another, but it may be used for stacking. It is less expensive than the fork lift truck and more durable per pound of weight because all the wheels of the platform truck support the load.
2. However, the platform truck must be used with skids or platforms. Skids use up more vertical space than pallets, do not distribute weight evenly, and are more expensive. Furthermore, the platform truck is not as maneuverable as the fork lift truck of the same wheel base, because the design of the fork lift truck permits the minimum

turning radius. Finally, in stacking, the platform truck requires a clearance for the front wheels, which are directly beneath the load and must avoid the skid of the bottom of the block.

3. The platform truck is most efficient on short hauls, where all its capacities can be used to best advantage.

(2) *Types and capacities.*

*Platform Trucks*

Capacity (lbs.)	Height lift (in.)	Type tires	Gas or electric
2,100		Solid	Electric.
2,500		do	Do.
3,000		do	Do.
4,000		do	Do.
4,000	60	do	Do.
6,000		do	Do.
6,000	60	do	Gas or electric.
7,000	92	do	Electric.
7,000	132	do	Do.
4,000	102	do	Gas.
6,000		do	Do

c. *Warehouse tractors.*

(1) *General.*

(a) *Description.*

1. The warehouse tractor is a wheeled, self-propelled vehicle to be used for towing trailer loads. This tractor is designed to include a large amount of power in a compact and maneuverable unit. It may be mounted on either

three or four wheels. A single steering wheel usually allows shorter turns but tends to reduce stability.

2. The smaller tractor is generally equipped with solid rubber tires, but the larger tractor, as well as the models to be used outdoors, may have pneumatic tires. Whenever possible, the coupler at the rear of the tractor will be automatic so that the operator can engage or disengage trailers without leaving his seat or the controls. The tractor may be powered by a gasoline engine, a battery-electric motor, or a gas-electric power unit.
3. The gasoline engine is usually a four-cylinder, four cycle, water-cooled engine with either a magneto or a battery ignition system. The electric type carries a storage battery in a special compartment over the drive wheels of the tractor.

*(b) Use.*

1. The warehouse tractor has sufficient power to pull loads of a practical size, yet it is small and maneuverable enough to move in the limited space of warehouses and storage areas. This tractor may be used for direct drag-towing of materials along the floor on skids, for pulling one or two trailers, or for towing a long train of trailers. Where the volume of materials and the regularity of schedules warrant its

use, the trailer train is the most practical and economical method of moving materials with a warehouse tractor. In this system the tractor acts as a locomotive for a trackless train of trailers. The train moves through the storage area, spotting trailers at intervals where they are to be used and picking up trailers that are to be moved.

2. It is a common temptation to use fork lift trucks over distances so great that much of their specialized efficiency in lifting and stacking is lost. General practice has shown that when the distance the load is to be carried exceeds 250 feet, tractors and trailers should be used in conjunction with lift trucks. Efficiency is improved by allowing the tractor and trailer to do the hauling, for which they were specifically designed.

## (2) *Types and capacities.*

*Tractors*

Draw bar pull (lb.)	Towing capacity (approx. tons)	Type tires	Gas or electric
2,000-----	40	Solid-----	Electric.
2,200-----	44	do-----	Do.
2,300-----	46	do-----	Do.
2,500-----	50	do-----	Do.
4,000-----	80	do-----	Do.
6,000-----	120	do-----	Do.
7,000-----	130	do-----	Do.
8,000-----	160	do-----	Do.
10,000-----	200	do-----	Do.

*Tractors—Continued*

Draw bar pull (lb.)	Towing capacity (approx. tons)	Type tires	Gas or electric
1,600	40	4-ply pneumatic	Gas.
1,700	55	6-ply pneumatic	Do.
2,000	48	4-ply pneumatic	Do.
2,100	30	do	Do.
2,200	35	do	Do.
2,300	50	Solid	Do.
2,600	40	Solid or pneumatic	Do.
3,000	70	6-ply pneumatic	Do.
3,200	60	do	Do.
3,300	9	do	Do.
4,000	85	do	Do.
4,200	11.5	do	Do.
4,500	90	do	Do.
5,000	50	do	Do.
7,500	200	8-ply pneumatic	Do.

*d. Wheeled cranes.*

*(1) General.*

*(a) Description.*

1. The wheeled crane is mounted on a wheeled, power-driven chassis to form a small mobile unit which can operate in limited spaces to lift, transport, and deposit materials which are not readily handled by other types of equipment.

2. This unit may be designed as a fixed-boom crane or as a sluing crane. In the fixed-boom crane, the boom is an integral part of the frame and can be swung only by steering the tractor on which it is mounted. On a sluing crane, the boom and hoisting unit are

mounted so that they may be swung without moving the tractor.

3. The fixed-boom crane is usually mounted on a standard tractor unit, with the boom projecting over the front wheels. The hoisting and topping units are mounted at the rear of the tractor, where the controls are easily accessible to the operator. Weights are set in the rear of the frame or in the rear wheels to counterbalance lifted loads and give added traction to the driving wheels.
4. The sluing crane is mounted on a specially designed power unit so that most of the load is supported by the driving wheels. This design creates a more compact unit, provides greater traction, and allows the engine to be placed in the rear as part of the counterweight.
5. On both types of cranes the boom can be topped to different heights to accommodate greater height of lift or greater reach, as may be desired. The hoisting unit operates independently of the vehicle's movement so that the load may be raised or lowered while the unit is traveling.
6. The cranes may be powered by a gasoline engine or by a battery-electric motor. Ordinarily, the fixed-boom crane has a gasoline engine because it is mounted on a standard tractor unit. The sluing crane is usually powered by an electric motor, since electric power

facilitates indoor use and permits a more compact design.

(b) *Use.*

1. Wheeled cranes are designed with varying capacities and can handle most lifting jobs found in storage areas. The wheeled crane is particularly useful because it handles loads which are of shapes and sizes that are moved with difficulty by other equipment. It can reach loads in places inaccessible to other types of materials-handling equipment and is flexible in use because it lifts and carries. It is small and compact and can be used in limited spaces and in the congested aisles found in small warehouses and storage areas.
2. The specific function of the wheeled crane is to provide crane facilities beyond the limitations of the rails or overhead tracks that support other types of cranes.

(2) *Types and capacities.*

*Wheeled Cranes*

Type boom	Capacity 3 ft. from bumper (lb.)	Reach	Tires	Gas or electric
Rigid---	2,000-----	3-7	Solid-----	Electric.
Do---	3,000-----	12-19	---do-----	Do.
Sluing---	3,000 (7 ft. from bumper).	7-19	---do-----	Do.
Do---	6,000-----	12.9	---do-----	Do.
Rigid---	6,000-----	12.9	---do-----	Do.
Sluing---	10,000 (5 ft. from bumper).	5.19-----	---do-----	Do.

*Wheeled Cranes—Continued*

Type boom	Capacity 3 ft. from bumper (lb.)	Reach	Tires	Gas or electric
Rigid---	1,000-----	-----	Solid-----	Gas and electric.
Do---	6,000-----	12.9	do-----	Do.
Sluing---	5,000 (5 ft. from bumper).	9	do-----	Gas.
Do---	6,000-----	-----	Pneumatic	Do.
Fixed---	6,000-----	3-10	Solid-----	Do.
Sluing---	8,000 (5 ft. from bumper).	12	do-----	Do.
Rigid---	10,000-----	3-10	Pneumatic	Do.
Sluing---	10,000-----	3.5-15	do-----	Do.
Rigid---	14,000-----	3-8	Solid-----	Do.
Sluing---	20,000-----	3-15	do-----	Do.

*e. Straddle trucks.*

(1) *General.*

(a) *Description.*

1. The straddle truck is an automotive, power-operated truck designed with a high, inverted framework that enables it to pass over and straddle a unit load in order to pick it up and carry it away.
2. The inverted frame places the motor and the operator on top of the vehicle to make room for the load and give the operator better visibility. Front and rear axles are raised high above the ground so that they will pass over the load to be straddled. The four supporting wheels are at the extreme corners of the vehicle and bear the

frame on four vertical shafts, or masts. Pneumatic tires are used to increase traction and protect the unit from road shocks. All four wheels may be steered, thus increasing the truck's maneuverability.

3. Straddle trucks are built in graduated sizes, and with varying capacities. They are equipped with high-powered gasoline engines.
4. The load to be carried is originally built up on platforms on bunkers. From that point it is treated as a unit load and handled mechanically. The load is straddled along its longitudinal axis. Hoisting shoes at the bottom of the straddled truck engage the load from both sides. The load is lifted to clear the ground and carried away.

(b) *Use.*

1. The straddle truck was originally designed to handle lumber at yard and storage areas, but it has come to be used extensively for carrying many other types of long, narrow items, such as girders, rods, and pipes. It may be used for carrying containers of bulk materials. An auxiliary fork lift or winch is sometimes attached to the front of the unit to increase its usefulness.
2. The unusual design of the straddle truck gives it several advantages in materials handling. It can carry heavy,

awkward-shaped packages which other industrial trucks have difficulty in moving. It can be self-loaded and unloaded without requiring the operator to leave his control position. Four-wheel steering allows this truck a short turning radius for its size. Finally, the straddle truck is highly mobile, with the power to pull heavy loads in rough going or to travel at high speed on good roads. The straddle truck's adaptability to many tasks makes it important in reducing the movement of materials by hand.

(2) *Types and capacities.*

*Straddle Trucks*

Capacity	Pneumatic type tires	Gas or electric
30,000-----	12-ply-----	Electric.
12,000-----	10-ply-----	Gas.
20,000-----	12-ply-----	Do.
30,000-----	do-----	Do.
14,000-----	10-ply-----	Do.

## SECTION VII

### PACKAGING AND CRATING

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#### 44. PROCESSING AND PREPACKAGING

- a. Clean articles subject to corrosion or other deterioration with either dry-cleaning solvent or soap solution.
- b. Where necessary, remove rust with aluminum-oxide abrasive cloth or crocus cloth.
- c. Where it is necessary, to paint, apply rust-inhibitive synthetic primer, sand and then paint surface.
- d. Where it is not necessary to paint, apply rust-preventive compound.
- e. Apply greaseproof wrapping paper to keep the corrosive-preventive film on the item.
- f. Apply waterproof barrier wrapping paper and seal seams and joints with waterproof adhesive.
- g. Select interior container considering maximum allowable weight of contents.
- h. Use cushioning materials (wood excelsior, creped cellulose wadding, hair felt, flexible corrugated paper, etc.) for such conditions as: protection of fragile articles against shocks and impacts, protection of finished surfaces against abrasion, protection of small projections on articles, filling of voids, etc.
- i. Block, brace, fasten or otherwise secure articles that do not fill the shipping containers, so as to pre-

vent movement in the container. (Brace by fastening wood or steel members to the shipping box in one direction, crosswise, or by cutting out portions of braces or supports to fit around a part of the machine. Bracing makes the article virtually a part of the box itself. Apply bracing to a part or parts of the article that will not be damaged by impact or by a blow sufficient to distort the box.)

j. Bolt articles such as machines or subassemblies. (In bolting, the article is rigidly attached to one face of the box or to a skid. Bolt articles when bracing is unnecessary or would permit damage by shock.)

k. Use creped paper linings for textile bags, barrels and drums where necessary to give protection against sifting, contamination, entrance or loss of water.

l. Where necessary, as a waterproof barrier, use lining for boxes, crates, etc. Linings should be in bag form, unless panel linings are required because of interior bracing and blocking.

## 45. INTERIOR CONTAINER TYPES

- a. Nailed wood interior boxes.
- b. Wire-bound interior boxes.
- c. Fiberboard interior boxes (regular slotted, center special slotted, full telescope design, special full-flat slotted and full overlap slotted styles).
- d. Folding cartons.
- e. Set-up boxes.
- f. Fiberboard cans and tubes.
- g. Bags, greaseproof, waterproof, etc.
- h. Metal-interior containers.

- i. Glass containers, plastic containers, and collapsible metal tubes.
- j. Kraft paper bags.
- k. Linings for textile bags, barrels and drums.

#### 46. EXTERIOR CONTAINER TYPES

- a. Sheathed nailed wood crates.
- b. Unsheathed nailed wood crates.
- c. Wood-cleated plywood boxes.
- d. Nailed wood shipping boxes (styles 1, 2,  $2\frac{1}{2}$ , 3, 4, 5 and 6).
- e. Wirebound shipping boxes.
- f. Fiberboard shipping boxes. (Fiberboard boxes are flexible and durable and do not break as easily as wooden boxes. However, the contents of the fiberboard box bear most of the weight, so that a box may look sound but the contents be badly damaged. Fiberboard boxes, therefore, should not be stacked as high as nailed wooden boxes.)
- g. Wood-cleated solid fiberboard boxes.
- h. Tight barrels.
- i. Slack barrels.
- j. Slack kegs.
- k. Metal drums.
- l. Metal cans and pails.
- m. Plywood drums.
- n. Fiberboard drums.
- o. Laminated shipping bags.
- p. Multiwall paper shipping sacks.
- q. Textile shipping bags.
- r. Bales and bundles.
- s. Pallets.
- t. Skids.

## 47. SELECTION OF SHIPPING CONTAINERS

a. Degree of protection required by the item—

- (1) *Easy load*—solid material (one-piece); boxed articles, paper or textiles; chest or kit of tools, wooden cabinet, boxed sturdy instruments.
- (2) *Average load*—goods in metal cans which are not packed in an inner container, bottles individually cushioned, hardware, and other articles in cartons.
- (3) *Difficult load*—long bolts and rods, dense articles such as rivets, delicate or dangerous articles such as instruments and explosives, machined parts or assemblies that require bracing, “floating,” etc.

b. Kinds of corrosion prevention and inner packaging applied to the item.

c. Weight and size of item or items to be placed in container.

d. Mode of transportation to be used (truck, railway, ship, etc.).

e. Availability of materials for making containers.

f. Time available for preparation of shipment.

## 48. STRAPPING

a. *General.* Strapping helps to keep side, top, and bottom boards from being forced loose by the weight of the contents in handling and to prevent splitting and breaking of these boards. Place straps at right angles to edges of a box and draw them tight enough to sink into the wood.

*b. Sizes of flat metal bands for various weights of boxes.*

Gross weight (pounds)	Dimensions of flat metal bands when different number of bands are used (inches)		
	1 band	2 bands	3 or more bands
Style 1 box			$\frac{3}{8} \times 0.020$
All other styles—			
To 70	$\frac{3}{8} \times 0.020$	$\frac{3}{8} \times 0.020$	$\frac{3}{8} \times 0.020$
71-125	$\frac{5}{8} \times 0.020$	$\frac{5}{8} \times 0.020$	$\frac{5}{8} \times 0.020$
126-175		$\frac{5}{8} \times 0.020$	$\frac{5}{8} \times 0.020$
176-250		$\frac{5}{8} \times 0.020$	$\frac{5}{8} \times 0.020$
251-400		$\frac{3}{4} \times 0.023$	$\frac{3}{4} \times 0.023$
401-1,000			$\frac{3}{4} \times 0.023$

*c. Gage of round wire for various weights of boxes.*

Gross weight (pounds)	Tensile strength per square inch					
	1 band		2 bands		3 bands	
	100,000 pounds p.s.i. (gage)	140,000 pounds p.s.i. (gage)	100,000 pounds p.s.i. (gage)	140,000 pounds p.s.i. (gage)	100,000 pounds p.s.i. (gage)	140,000 pounds p.s.i. (gage)
Style 1 box					15	16
All other styles—						
To 70	14	15	15	15	15	15
71-125	13	14	14	15	14	15
126-175			13	14	13	14
176-250			13	13	13	13
251-400			12	12	13	13
401-1,000					12	12

## 49. WOODS

### a. Classification of woods.

(1) *Groups.* The woods which may be used as lumber for nailed wooden boxes are classified in the following groups:

#### *Group 1*

Aspen	Cypress	Pine, ponderosa
Basswood	Fir, alpine	(western yellow)
Buckeye	Fir, balsam	Pine, red (Norway)
Butternut	Fir, noble	Pine, sugar
Cedar	Fir, white	Pine, white
Chestnut	Magnolia	Redwood
Cottonwood	Pine, jack	Spruce
Cucumber tree	Pine, lodgepole	Willow
		Yellow poplar

#### *Group 2*

Douglas fir	Hemlock (western)	Pine, southern
	Larch (tamarack)	

#### *Group 3*

Ash, black	Elm, white	Maple, soft
Ash, pumpkin	Gum, black	Sycamore
	Gum, sweet	Tupelo, water

#### *Group 4*

Ash, white	Elm, rock	Maple, hard
Beech	Hackberry	Oak
Birch	Hickory	Pecan

(2) *Group characteristics.* The above groups are set up so that each one is limited to woods with similar characteristics of importance to box design. These characteristics include density, flexural and compression strength, stiffness, shock absorption, and nail-holding power. Variations of the characteristics of woods within any one group are not great enough to interfere with their use in box design. Box designs

should be based on the characteristics of each group of woods.

(3) *Use of groups.* In general, the density of woods increases in order from group 1 to group 4. There is the same progressive increase from group 1 to group 4 in strength, nail-holding power, and the other characteristics indicated above. Therefore, for a box of the same dimensions designed to carry a stated load under given conditions, the required thickness of boards is greatest when woods of group 1 are used, and least when woods of group 4 are used. Likewise, to provide the total nail-holding power required for a box, more nails, longer nails, nails of a larger diameter, or a combination of these must be used if woods of group 3 are used instead of woods of group 4, or of group 2 instead of group 3.

*b: Lumber standards.* The lumber used in the manufacture of nailed wooden boxes must meet the following standards:

- (1) Lumber will be seasoned to a moisture content of not more than 18 percent nor less than 12 percent of its oven-dry weight.
- (2) Pieces will be cut to length and dressed on at least one side.
- (3) Pieces will be free from all defects that materially weaken them, expose the contents of the box to damage, or interfere with the prescribed fabrication or nailing.
- (4) No knot will have a diameter exceeding one-third of the width of the piece.

## 50. NAILS

*a. Types of nails.* In the manufacture of wooden boxes, three types of nails are used: the standard box nail, the cooler, and the sinker. The cooler and the sinker are identical except for the head. The head of a cooler is flat on the underside, while the head of a sinker is slightly smaller and cone-shaped on the underside. The standard box nail is the same length as the cooler or the sinker but is smaller in diameter (that is, has a larger gage number).

*b. Coated nails.* Nails used in the making of boxes may be smooth or cement-coated. If two boards are to be fastened together with nails and the nails clinched in the under board, smooth nails may be used. If two boards are to be fastened together with nails not clinched, cement-coated nails should be used. Cement-coated nails frequently have from 50 to 100 percent more nail-holding power than smooth nails of the same diameter and length.

*c. Selecting nails.* A rule-of-thumb in selecting nail size is—

The size of pennies is equal to the width of the board (measured in eighths of an inch) held by the head of the nail plus two. Thus, to nail a board of  $\frac{1}{2}$ " lumber to form a box, a nail of 6-penny ( $\frac{1}{2} = \frac{4}{8}; 4 + 2 = 6$ ) is required.

*d. Nails used in the manufacture of shipping boxes.*

(1) *Coated nails.*

Size	Length (in.)	Gage	Approximate number per pound
2-penny-----	1	16½	1,300
3-penny-----	1½	16	950
4-penny-----	1¾	15½	710
4½-penny-----	1½	15½	650
5-penny-----	1¾	15	536
6-penny-----	1¾	13½	306
7-penny-----	2¼	13½	268
8-penny-----	2¾	12½	186
9-penny-----	2¾	12½	167
10-penny-----	2¾	11½	118

(2) *Smooth box nails.*

Size	Length (in.)	Gage	Approximate number per pound
2-penny-----	1	15½	1,010
3-penny-----	1¼	14½	635
4-penny-----	1½	14	473
5-penny-----	1¾	14	406
6-penny-----	2	12½	236
7-penny-----	2¼	12½	210
8-penny-----	2½	11½	145
9-penny-----	2¾	11½	132
10-penny-----	3	10½	94
12-penny-----	3¼	10½	88
16-penny-----	3½	10	71
20-penny-----	4	9	52
30-penny-----	4½	9	46
40-penny-----	5	8	35

(3) *Sinkers or coolers, coated.*

Size	Length (in.)	Gage	Approximate number per pound
2-penny-----	1	16	1,084
3-penny-----	1 $\frac{1}{8}$	15 $\frac{1}{2}$	848
4-penny-----	1 $\frac{3}{8}$	14	488
5-penny-----	1 $\frac{5}{8}$	13 $\frac{1}{2}$	364
6-penny-----	1 $\frac{7}{8}$	13	275
7-penny-----	2 $\frac{1}{8}$	12 $\frac{1}{2}$	212
8-penny-----	2 $\frac{3}{8}$	11 $\frac{1}{2}$	142
9-penny-----	2 $\frac{5}{8}$	11 $\frac{1}{2}$	130
10-penny-----	2 $\frac{7}{8}$	11	104
12-penny-----	3 $\frac{1}{8}$	10	77
16-penny-----	3 $\frac{1}{4}$	9	61
20-penny-----	3 $\frac{3}{4}$	7	37
30-penny-----	4 $\frac{1}{4}$	6	29
40-penny-----	4 $\frac{3}{4}$	5	21
50-penny-----	5 $\frac{1}{4}$	4	16
60-penny-----	5 $\frac{3}{4}$	3	13

e. *Size of nails for fastening top and bottom to sides.*

Thickness of side (in.)	Size of nails		
	Group I wood	Group II wood	Groups III and IV wood
Under $\frac{1}{2}$ -----	None-----	None-----	None.
$\frac{1}{2}$ to $\frac{39}{64}$ -----	6-penny-----	5-penny-----	4-penny.
$\frac{5}{8}$ to $\frac{7}{8}$ -----	7-penny-----	6-penny-----	5-penny.
$\frac{15}{16}$ to $1\frac{1}{16}$ -----	8-penny-----	7-penny-----	

*f. Spacing of nails.<sup>1</sup>*

Size of nails	Spacing <sup>2</sup> (in.)	
	When driven into side grain of end	When driven into end grain of end
6-penny or smaller-----	2	$1\frac{3}{4}$
7-penny-----	$2\frac{1}{4}$	2
8-penny-----	$2\frac{1}{2}$	$2\frac{1}{4}$
9-penny-----	$2\frac{3}{4}$	$2\frac{1}{2}$
10-penny-----	3	$2\frac{3}{4}$
12-penny-----	$3\frac{1}{2}$	3
16-penny-----	4	$3\frac{1}{2}$
20-penny-----	$4\frac{1}{2}$	4

<sup>1</sup> Except the nailing of top and bottom of sides.

<sup>2</sup> The spacing of cement-coated nails fastening the sides, tops or bottoms to the ends and cleats shall not be greater than that given in this table. When, because of small knotholes or checks in the nailing end, it is necessary to exceed this spacing, the distance between any two adjacent nails shall not be greater than  $1\frac{1}{2}$  times the spacing given in this table.

**51. NAILS AND LUMBER FOR STYLES 1, 2, 2½, 4, AND 5 NAILED WOODEN BOXES  
(TYPE 3)**

Weight of contents (lb.)	Style of box: <sup>2</sup>	Woods of groups 1 and 2				Woods of groups 3 and 4			
		Min- imum thick- ness of sides, tops, and bottoms (in.) <sup>1</sup>	Size of nail for nailing sides, tops, and bottoms to ends and cleats	Min- imum thick- ness of ends (in.) <sup>1</sup>	Min- imum thick- ness and width of cleats (in.) <sup>1</sup>	Size of nail for nailing sides, tops, and bottoms to ends and cleats		Min- imum thick- ness of ends (in.) <sup>1</sup>	Min- imum thick- ness and width of cleats (in.) <sup>1</sup>
						Group 1 (penny)	Group 2 (penny)		
To 100	4 or 5	½	8	7	¾	¾ x 2 ½	¾ x 2 ½	5	5/8
To 100	2 or 2½	½	7	6	⁵/₈	⁵/₈ x 2 ½	⁵/₆	5	5/8
101-250	4 or 5	⁵/₈	8	7	²⁹/₃₂	²⁹/₃₂ x 2 ½	½	5	¾
101-250	2 or 2½	⁵/₈	8	7	¾	¾ x 2 ½	½	5	5/8
251-400	4 or 5	¾	10	9	¹¹/₁₆	¹¹/₁₆ x 3 ½	⁵/₈	6	13/16
251-400	2 or 2½	¾	8	7	³/₄	¹¹/₁₆ x 3 ½	⁵/₈	5	¾
401-600	2 or 2½	²⁹/₃₂	9	8	²⁹/₃₂	¹¹/₁₆ x 3 ½	¹¹/₁₆	6	13/16
601-800	2 or 2½	¹¹/₁₆	10	9	¹¹/₁₆	¹¹/₁₆ x 3 ½	¾	7	13/16
801-1,000	2 or 2½	¹¹/₁₆	12	12	¹³/₁₆	¹³/₁₆ x 4 ½	⁷/₈	8	1 ¼

<sup>1</sup> When minimum thickness shown is exceeded, nail sizes will be increased to correspond.

<sup>2</sup> Where depth of cleated-style box is 5 inches or less, each side and each end will be made from one piece, and the thickness of ends will not be less than the combined thickness of the end and cleat specified above.

## SECTION VIII

### GRAVES REGISTRATION

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#### **52. GENERAL**

The Quartermaster General has responsibility for the establishment and organization in time of war of a Graves Registration Service for the purpose of insuring identification and proper burial of American military personnel who die outside the continental limits of the United States. To fulfill this responsibility, trained graves registration companies must be prepared to follow combat units in order that immediate recovery and evacuation of deceased personnel may be accomplished, and that proper identification and burial may be assured.

#### **53. RECOVERY AND EVACUATION**

*a.* The graves registration company is normally assigned to the Army on the basis of one platoon of a graves registration company to support a combat division.

*b.* Combat units will usually evacuate remains to a battalion, regimental, or division collecting point where personnel of the graves registration platoon will receive the remains.

*c.* Remains are evacuated by graves registration personnel from the collecting point to the site of the temporary military cemetery.

- d. Identification is verified at the cemetery by trained *identification technicians*. Items of personal effects are removed from the remains, properly inventoried, recorded and transported to the class II and IV depot designated to receive personal effects.
- e. Burial is recorded by plot, row, and grave number.

#### 54. IDENTIFICATION

- a. Initial identification is performed at the collecting point in order that maximum information may be obtained concerning the identity of the deceased from members of his unit when sufficient identification is not present on the remains.
- b. The emergency medical tag placed on the remains should include the name, rank, serial number of the decedent, date and place of death, and designation of his unit. *Personal effects should not be removed from the remains until remains arrive at cemetery and positive identification has been made* (par. 55).
- c. Identification prior to burial will be made at the cemetery, if not previously established, and all data utilized in initial identification at the collecting point will be rechecked at the cemetery. Identification tags and all items of personal effects on the remains will be meticulously scrutinized in an effort to establish positive identification.
- d. Fingerprints will be taken prior to burial of remains in those cases where there is a question of identity.
- e. Scars, tattoos and other physical characteristics

which may be valuable in later investigations will be recorded.

## 55. PERSONAL EFFECTS

- a. Personal effects are not removed from the remains until arrival at the cemetery.
- b. After identification has been established, personal effects found on the remains will be removed prior to interment.
- c. Personal effects of a non-Government issue nature will be inventoried, packaged and transmitted to the communications zone installation designated to handle effects for shipment to the Effects Depot in the continental United States and ultimate delivery to the next of kin.
- d. When identification *cannot* be made, the personal effects of the unidentified deceased will be inventoried, packaged, and transmitted as in *c* above to the communications zone installation which handles effects to be shipped to the Effects Depot in the Continental United States. However, one complete copy of the report of burial, together with a notation of any other pertinent information, will be inclosed in the package containing the effects.

## 56. TEMPORARY MILITARY CEMETERIES

- a. The establishment of division cemeteries will be held to a minimum. This will necessarily depend upon the tactical situation.
- b. The site for a temporary military cemetery will usually be selected by a representative of the army or corps commander.
- c. Selection of the temporary cemetery site

should be carefully made taking into consideration the following factors:

- (1) The site should be near a good road network on high level ground free from rock formation.
- (2) Site should have a low water table.
- (3) Site should not be low or swampy terrain.

d. The Corps of Engineers should be consulted in the selection and layout of the cemetery.

## 57. BURIALS

a. Graves will be prepared by attached service troops or prisoners of war. The dimensions of a grave are 5 feet in depth, 6½ feet in length, 3 feet in width. The intervals between each grave are 3 feet laterally from the edge of the adjoining grave opening and 4 feet linearly from the edge of preceding open grave.

b. Graves are aligned in both directions.

c. One identification tag will be interred with the remains and one tag firmly affixed to the grave marker.

d. Care will be taken to place a cross or a star of David on the grave in accordance with the religious preference of the decedent. The grave marker is placed at the head of the grave at a point 1½ feet from the edge of the grave opening.

e. Grave location will be carefully recorded on the cemetery plot map and on the burial report.

f. Graves are numbered usually from left to right and the rows from rear to front.

g. The burial report will be accomplished in every detail. One copy will be retained in the cemetery

files and the other copies will be distributed in accordance with issued instructions.

*h.* Landscaping should be held to a minimum. Permanent buildings or other permanent type facilities should not be constructed since these cemeteries are considered temporary. Cemeteries will be seeded where possible and properly maintained to present the appearance of dignified simplicity.

## SECTION IX

### TRANSPORTATION

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#### 58. MOTOR TRANSPORTATION

*a. Vehicle capacities (truck capacities for cargo, men and equipment).*

Trucks	Cargo <sup>1</sup>		Men and equipment <sup>1</sup>
	Poor, rough road	Good, hard-surfaced road	
1/4-ton			<sup>2</sup> 3
3/4-ton			<sup>2</sup> 8
1 1/2-ton			<sup>2</sup> 15
2 1/2-ton 6 x 6 LWB:			
With trailer	3 1/2 tons	5 tons	25
Without trailer	2 1/2 tons	do	25
2 1/2-ton 6 x 6 SWB:			
With trailer	3 1/2 tons	do	18
Without trailer	2 1/2 tons	do	18
2 1/2-ton 6 x 6 COE, 15 or 17-ft body (no tlr).	2 1/2 tons	do	30
5-ton truck-tractor w/10-ton semitrailer.	( <sup>3</sup> )	10 tons	40
5-ton truck-tractor w/2,000-gal tank, semitrailer.	( <sup>3</sup> )	2,000 gallons.	

<sup>1</sup> Trucks carrying either cargo, or men and equipment—not both.

<sup>2</sup> This figure represents men, excluding driver.

<sup>3</sup> Not generally used.

*b. Pertinent data for Army vehicles.*

Name	Weight:			Shipping dimensions			Capacity: (1) Fuel (2) Crankcase	Miles per gallon and cruising range
	(1) Net (2) Pay- load (3) Gross	Length (in.)	Width (in.)	Height (in.)	Cu. ft.	Sq. ft.		
Motorcycle, solo—	(1) 537 (2) 200 (3) 737	88	36 $\frac{1}{4}$	41	78 (54)	80 (16)	(1) 3 $\frac{1}{2}$ gallons. (2) 3 quarts	42 (37)
Light sedan, 5-passenger, 4 x 2— Chevrolet, Plymouth, Ford.	(1) 3,275 (2) 800 (3) 4,075	195 $\frac{7}{8}$	72 $\frac{3}{4}$	69 $\frac{5}{8}$	575	99	(1) 16 gallons. (2) 6 quarts	147 (120)
Medium sedan, 5-passenger, 4 x 2— Buick, Packard.	(1) 3,700 (2) 700 (3) 4,400	208 $\frac{1}{2}$	76 $\frac{1}{8}$	63 $\frac{1}{2}$	583	110	(1) 17 gallons. (2) 5 $\frac{1}{2}$ quarts	14 224
Truck, $\frac{1}{4}$ -ton, 4 x 4—Ford, Willys..	(1) 2,453 (2) 800 (3) 3,253	132 $\frac{1}{4}$	62	52	331	57	(1) 15 gallons. (2) 5 quarts	18.4 20.9 312 1 355

Overdrive.

Name	Weight: (1) Net (2) Pay- load (3) Gross	Shipping dimensions				Capacity: (1) Fuel (2) Crankcase	Miles per gallon and cruising range
		Length (in.)	Width (in.)	Height (in.)	Cu. ft.		
Truck, weapons carrier $\frac{3}{4}$ -ton, 4x4— Dodge.	(1) 5,250 (2) 1,500 (3) 6,750	166 $\frac{1}{8}$	82 $\frac{3}{4}$	81 $\frac{1}{8}$	529	102 (1) 30 gallons--- (2) 5 quarts---	8 240
w/ winch							
(1) 5,550 (2) 1,500 (3) 7,050	224	86	104 $\frac{1}{2}$	1,001	138 (1) 30 gallons--- (2) 5 quarts---	9 270	
(1) 7,545 (2) 3,000							
(3) 10,545 (1) 10,050 (2) 5,000	264 $\frac{1}{4}$	86 $\frac{1}{8}$	91 $\frac{1}{8}$	1,429	156 (1) 40 gallons--- (2) 10 quarts---	7.5 300	
(3) 15,050							
w/ winch							
(1) 11,000 (2) 5,000 (3) 16,000							
(3) 21,700	291 $\frac{1}{8}$	101	111	1,917	195 (1) 60 gallons--- (2) 16 quarts---	3.3	
(3) 12,200 (1) 12,200 (2) 9,000	202	95	107 $\frac{1}{2}$	1,210	137 (1) 60 gallons--- (2) 14 $\frac{1}{2}$ quarts---	3.2 200	
(3) 21,200							

Trailer, cargo, $\frac{1}{4}$ -ton	(1) 550 (2) 500 (3) 1,050	78  145 $\frac{1}{2}$	55 $\frac{1}{2}$  71 $\frac{1}{8}$	42  73	141  438	42  72
Trailer, cargo, 1-ton	(1) Steel, 1,470 Wood, 1,282 (2) 2,000 (3) Steel, 3,470 Wood, 3,282					
Trailer, water tank, 250-gal, 1-ton	(1) 1,400 (2) 2,000 (3) 3,400	136 $\frac{1}{2}$	71 $\frac{1}{8}$	58	324	67

## a. Capacity of standard United States military railway cars.

Type of car	Gage Ft.-in.	Capacity <sup>1</sup>		Weight empty in tons	Inside dimensions		
		Tons	Cu. ft.		Length	Width	Height
Box	4-8½	20		9	239½	7-7½	6-5
Do	3-3½	30		15	34-6	7-1	6-1
Do	3-6	30		15	34-6	7-1	6-1
Do	4-8½	40		20	39-9	8-0	6-9
High-side gondola	4-8½	20		8	23-9½	7-6	4-0
Do	3-6	30		10	34-6	6-11½	4-0
Low-side gondola	3-3½	30		9	34-6	6-11	1-6
Do	4-8½	40		18	40-6½	7-6	1-6
Flat	4-8½	56		17.5	40-9	8-5	
9,900-gallon tank	4-8½	40		20	37-2	3-6-9	
5,000-gallon tank	3-6	30		16	27-6	3-5-6	
Refrigerator	4-8½	35		21	32-8	6-11	6-6

<sup>1</sup> Capacity for personnel may be computed on a basis of 8 square feet per man and equipment for those cars suitable for this purpose.

<sup>2</sup> Height of sides.

\* Diameter.

b. Characteristics of standard United States commercial railway cars.  
 (1) Passenger cars.<sup>1</sup>

Item	1	2	3	4
	Day coach <sup>2</sup>	Tourist pullman		Standard pullman <sup>3</sup>
Length in feet.	65-75	65-75	65-75	65-80
Number of sections	None	13-16	13-16	12-16
Maximum seating, 2 men to each double seat <sup>4</sup>	60-70	52-64	52-64	53-64
Maximum seating, 3 men to each 2 double seats <sup>4</sup>	45-52	39-48	39-48	40-48
Maximum sleeping, 2 men per berth	None	52-64	52-64	53-64
Sleeping capacity, 3 men per section	do	39-48	39-48	40-48
Sleeping capacity, 1 man per berth	do	26-32	26-32	27-32

<sup>1</sup> Most of the new types are not listed.

<sup>2</sup> Limited number of steel coaches, 70 feet long or over, available.

<sup>3</sup> 12 sections and drawing room or 16 sections and no drawing room.

<sup>4</sup> Double seat—A seat having the capacity of 2 men.

## (2) Freight cars.<sup>3</sup>

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Type of car	Gage Ft.-in.	Capacity 1		Weight empty in tons	Inside dimensions		
		Tons	Cu. ft.		Length	Width	Height
Box <sup>2</sup>		30	2,750	18	36	8-6	9
Do.		40	3,100	20	40-6	8-6	9
Do.		50	3,100	24	40-6	8-6	9
Gondola		50	1,570	22	40	9-11	4
Do.		70	1,920	25	48	10	4
Flat		40		18	40	9	
Do.		50		20	45	9	
Do.		70		25	50	9	
8,000-gallon tank		40		20	33	6-6	
10,000-gallon tank		50		24	33	7-2	
Refrigerator		30	2,570	28	40-6	8-2	7-2
Do.		40	2,570	30	40-6	8-2	7-6
Stock		30	2,625	20	36	8-9	8-6
Automobile		40	3,100	20	40-6	8-6	9
Do.		50	3,850	25	50-6	8-6	9
Baggage				45	60	9-1	8
Caboose				20	27-6	8-2	7
Diner				90	78-6	8-6	

<sup>1</sup> There are no "standard" dimensions of commercial cars. Figures given here are for some types in common use.

<sup>2</sup> Approximately 80 percent of all box cars in use are between 40 and 42 feet inside length.

<sup>3</sup> The Official Railway Equipment & Publication Co., 424 W. 33d St., New York, N. Y., shows by individual car initials and numbers, the marked capacity, length, dimensions and cubic capacity of all American railway cars used to transport freight.

*c. Maximum bulk loading for standard U. S. freight cars.\**

Capacity of cars in tons-----	30	40	50
Item	Actual capacity of cars in tons		
Ammunition-----	30	40	50
Blankets, baled-----	27	32	40
Bread-----	19	24	30
Canned goods, boxed-----	30	36	45
Cement-----	30	40	50
Clothing, baled-----	27	32	40
Flour-----	30	40	50
Gravel-----	30	40	50
Harness and saddlery-----	18	20	30
Hay, baled-----	15	20	25
Iron, corrugated-----	30	40	50
Meat-----	15	24	35
Motor vehicle parts-----	24	28	40
Oats-----	18	24	30
Pails-----	30	40	50
Rifles, in chests-----	30	40	50
Sand-----	30	40	50
Sandbags-----	30	40	50
Stone, any form-----	30	40	50
Sugar-----	30	40	50
Tentage-----	15	20	30
Ties, railway-----	19	26	32
Tools:			
Engineer-----	30	40	50
Truck-----	30	40	50
Wire:			
Barbed-----	30	40	50
Telephone-----	30	40	50

\*A rated capacity of a car in tons does not mean that this rated tonnage of all articles can be carried. This table shows the tonnage of military freight that can be carried in freight cars of common rated capacities.

*d. Dimensions and capacities of British railway wagons.*

Type of wagon or car	Tons (Br.)	Capacity				Inside dimensions (feet)		
		Men at 8 sq. ft. per man w/ equip.	Animals, L-draft, 22 inches, average width	Sq. ft.	Cu. ft.	Tare weight (Br. tons)	Length	Width
Covered goods: 4-wheel.								
Short.	10	16 23	8 12	133 185	838 1,164	7 8	17.3 24	7.7 7.7
Covered goods: 4-wheel.								
Short.	20	29	16	231	1,355	9.5	30	7.7
Open high-sided, 4-wheel, short.	10	16	18	128	589	6.7	17.1	7.5
Open high-sided; 4-wheel.								
Short.	20	21	11	168	806	9.7	21.5	7.8
Open low-sided; 4-wheel.								
Short.	10	16 28		128 220	371 462	6 7.8	17.1 24.7	7.5 8.9
Open low-sided, 4-wheel.	20							
Open flat: 4-wheel.								
Short.	10			117		5.3	16.0	7.3

Open flat:						
4-wheel	20					
Bogie	30					
Bogie	35					
Bogie	40					
Open, well, 4-wheel	20					
Refrigerator, 4-wheel	10	9	107	749	9.9	14.8
Live stock	10	18	142	994	8.4	18.5
Tank or cistern	10		2,860		8.8	17.2
Do	14		4,000		(6)	17.4
Do	20		5,000		(6)	7.2
Do	40		10,000		(6)	-
War flats bogie	50		340		18.7	40.0
Brake vans, 4-wheel	25		158	1,264	25.0	6.6
						8.0

<sup>1</sup>In well.

<sup>2</sup>With ice chambers.

<sup>3</sup>Gallons.

<sup>4</sup>Inside diameter.

<sup>5</sup>Not available.

e. Maximum bulk loading for British freight cars.

Article	Tons	Article	Tons
Ammunition-----	10	Iron, corrugated and scrap, lead.	10
Ballast-----	10	Mail, canteen stores, etc.	5
Barbed wire-----	10	Meat, frozen-----	7
Blankets, baled-----	7	Medical stores-----	8
Clothing, baled-----	7	Oats-----	8
Bread and biscuits-----	6	Ordnance stores, general.	5
Canned goods and potatoes, etc.	8	Parts, motor vehicle.	8
Cement-----	10	Petrol, in tins or cases.	7
Coal-----	10	Railroad material (excluding bal- last).	9
Coke-----	5	Rifles, in chests-----	10
Engineer supplies, general.	7	Sandbags-----	6
Flour-----	7	Sugar, beans, etc-----	9
Gravel, road stone, etc.	10	Timber, ties, hut sections, and tent- age.	6
Harness and saddle- lery.	6	Tools and telephone wire.	10
Hay, compressed, baled.	5		
Hay, steamed, pressed.	3		

## 60. WATER TRANSPORTATION

### a. Data concerning U. S. cargo ships.

Data	Liberty (EC2)*	Victory		C1B	C1-M-AV1 (coaster)	T2E (tanker)	ZET1 (converted Liberty tanker)
		V	C2	V	C3		
Gross registered tonnage	7,100	7,600	7,600	6,700	3,860	10,200	7,000
Over-all length, in feet	442	455	455	418	339	524	442
Breadth, in feet	57	62	62	60	50	68	57
Speed, sustained (knots)	11	15½	16½	14	11	14½	11½
Draft, in feet, loaded to summer freeboard	28	28	28	28	23	30	28
Deadweight tonnage	10,800	10,600	10,850	9,100	5,000	16,760	10,800
Measurement tonnage space:							
Dry cargo	11,500	11,750	11,750	11,400	5,675	375	—
Refrigerated cargo					275	—	—
Barrel cargo capacity	5,000	5	5	5	4,000	141,000	65,000
Number of holds	50	50	50	30	4	9	9
Ton capacity of heaviest boom	50	50	50	30	30	5	5

\*See additional data relating to the Liberty ship (EC2).

b. Additional data relating to the Liberty ship (EC2).

Capacity below deck	Hatch 1	Hatch 2	Hatch 3	Hatch 4	Hatch 5
Hatch dimensions	33' 9" x 20'	33' 9" x 20'	35' x 20'	33' 9" x 20'	20' x 20'
Cargo space in M/Ts—					
Hold	900	2,300	1,500	1,300	1,300
Between decks	1,000	1,100	600	700	800
Deep tanks	140	270	460		

## 61. AIR TRANSPORTATION

a. *Airplane.* Delivery by airplane to the airhead is the most efficient method but requires an air strip at the unloading point for loading purposes. The following table shows cargo-carrying characteristics of carrier aircraft:

*Cargo-Carrying Characteristics of Carrier Aircraft*

Note. Distances are in nautical miles (Conversion factor: 1 nautical mile equals 1.16 status miles).

Type of aircraft	Range 500 miles	Range 1,000 miles	Range 1,500 miles	Range 2,000 miles	Range 3,000 miles
	Pounds	Pounds	Pounds	Pounds	Pounds
C-46	11,872	10,250	7,000	4,000	0
C-47	7,500	5,000	3,700	2,000	0
C-54	20,000	20,000	18,900	15,700	6,000
C-82	11,775	11,000	6,400	2,350	0
C-74	44,000	35,000	27,500	20,000	6,000
C-119	20,000	18,000	11,000	5,500	0
YC-97	41,500	35,000	28,000	22,000	10,000
C-97 A	Maximum	36,000	36,000	32,500	22,600
C-124	Maximum	47,300	40,000	32,300	17,000

*b. Glider.* Delivery by glider is expensive but can be accomplished without the use of a prepared air strip. The following table shows characteristics of gliders:

*Characteristics of Gliders*

Type glider	Pay load	Cruising speed
CG-15A.....	4,600	150
CG-18A.....	8,000	( <sup>1</sup> )
CG-20A.....	16,000	190

<sup>1</sup> Speed of CG18A depends on speed of airplane.

*c. Parachute.* Delivery by parachute is comparatively inefficient and should be used only when more desirable methods are not available. The following table gives weights and capacities in air delivery:

*Weights and Capacities in Air Delivery*

Type of Load	Diameter (feet)	Weight (pounds)	Average safe load (pounds)	Gross weight (pounds) (canopy, container and safe load)
Canopy parachute air de- livery—				
G1.....	24	20	300	320
Air delivery:				
Type A-4.....	24	13.25	100	135.25
Type A-5.....	24	42	175	237
Type A-6.....	24	15	150	185
Type A-7.....	24	.50	150	170
Cargo net.....	24	11	189	220
Cargo dropping by parachute:				
G2.....	24	55	3,000	-----
G3.....	28	75	3,000	-----
G4.....	36	98	3,000	-----
G5.....	48	138	3,000	-----

G-3 Cargo parachute 28-foot:

<i>Safe load (not to include rigging) (pounds)</i>	<i>Rate of descent (feet per second)</i>	<i>Safe load (not to include rigging) (pounds)</i>	<i>Rate of descent (feet per second)</i>
500-----	40	2,000-----	80
1,000-----	57	2,500-----	87
1,500-----	70	3,000-----	97

G-4 Cargo parachute, 36-foot:

<i>Safe load (not to include rigging) (pounds)</i>	<i>Rate of descent (feet per second)</i>	<i>Safe load (not to include rigging) (pounds)</i>	<i>Rate of descent (feet per second)</i>
500-----	32	2,000-----	63
1,000-----	44	2,500-----	70
1,500-----	55	3,000-----	77

G-5 Cargo parachute, 48-foot:

<i>Safe load (not to include rigging) (pounds)</i>	<i>Rate of descent (feet per second)</i>	<i>Safe load (not to include rigging) (pounds)</i>	<i>Rate of descent (feet per second)</i>
500-----	25	2,000-----	47
1,000-----	35	2,500-----	53
1,500-----	42	3,000-----	58

90 ft. cargo parachute—Maximum 6,000 pounds limit:

<i>Safe load (not to include rigging)</i>	<i>Rate of descent (feet per second)</i>
2,700-----	24.4
1,500 feet, minimum safe altitude.	

85-foot ribbon cargo parachute—6,000 pounds limit:

<i>Safe load (not to include rigging)</i>	<i>Rate of descent (feet per second)</i>
3,000 pounds-----	22.4
4,000 pounds-----	25
1,500 feet, minimum safe altitude.	

*d. Type loads for each delivery unit.* The shape and strength of the various types of air delivery units are to be taken into consideration in the delivery of different types of supplies.

(1) *Type A-4.* Type A-4 load consists of packaged rations, small spare parts, light radios, medical supplies and light equipment.

- (2) *Type A-5.* Type A-5 load consists of arms, ammunition, rations, medical supplies, engineer tools, sturdy equipment, and standard metal containers filled with gasoline, oil and water.
- (3) *Type A-6.* Type A-6 load consists of rations, ammunition, in bundles, light radios, and medical supplies.
- (4) *Type A-7.* Type A-7 load consists of ammunition boxes.
- (5) *Cargo net.* The cargo net consists of irregularly shaped loads, ammunition in boxes, sturdy equipment that does not require additional packing or protection, and metal containers of gasoline, oil or water.

## SECTION X

### TABLES OF WEIGHTS, MEASURES AND CONVERSIONS

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#### 62. WEIGHTS AND MEASURES OF VARIOUS NATIONS<sup>1</sup>

Country	Weight or measure	English or American equivalent	Metric equivalent
Abys-sinia.	ardeb-----	0.115 to 0.333 bu.	4.039 to 11.745 l.
	cuba(kuba)-----	0.268 gal-----	1.016 l.
	daula-----	2.5 bu-----	90.875 l.
	ferasla-----	40.00 lb-----	18.143 kg.
	kend-----	18.00 in-----	0.457 m.
	kunna-----	0.5 pk-----	4.405 l.
	mand (mond).-----	21.942 lb-----	9.952 kg.
	ounce-----	430.00 gr-----	27.864 gm.
	pic-----	27.00 in-----	0.686 m.
	pound: ivory-----	5,160.00 gr-----	334.368 gm.
	coffee-----	7,740.00 gr-----	501.550 gm.
	rotl(rotolo)-----	4,800.00 gr-----	311.040 gm.
Afghan-istan. <sup>2</sup>	goess(guz)-----	45.67 in-----	1.16 m.
Algeria.*			
Argen-tina.*	arroba-----	25.35 lb-----	11.498 kg.
	fanega-----	1.5 imp. bu-----	54.525 l.
	quintal-----	101.40 lb-----	45.994 kg.
	vara-----	34.12 in-----	0.866 m.

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Australia	Weights and measures of Great Britain.		
Austria <sup>3*</sup>	centner----- eimer----- fuss----- joch----- meile----- metzen----- pfund-----	123.46 lb----- 12.49 gal----- 12.446 in----- 1.43 acres----- 4.714 mi----- 1.7 imp. bu----- 1.235 lb-----	56.06 kg. 56.59 l. 0.316 m. 5,754.64 m. <sup>2</sup> 7.586 km. 61.49 l. 280.00 gm.
Belgium.*	aune <sup>4</sup> ----- litron <sup>4</sup> ----- livre <sup>4</sup> -----	39.37 in.; 0.908 qt. (dry); 1.0567 qt. (liq). 2.2046 lb-----	1.00 m. 1.00 l. 1.00 kg.
Bolivia <sup>5*</sup>	mare (mining produce).	507.00 lb-----	229.97 kg.
Brazil <sup>6#</sup>	alquire----- arroba----- libra----- oitava (outava). quintal----- vara-----	1.00 imp. bu----- 32.379 lb----- 1.012 lb----- 55.34 gr----- 129.54 lb----- 42.796 in-----	36.35 l. 14,687.40 gm. 459.033 gm. 3.65 gm. 58.749 kg. 1.087 m.
British India. <sup>7</sup>	biggah (bigha). candy----- guz----- hanth----- maund----- pice----- seer----- ser----- tola-----	0.667 acre----- 2.35 ft----- 36.00 in----- 19.125 in----- 82.285 lb----- 163.333 gr----- 0.4 bu----- 2.204 lb----- 180.00 gr-----	24.577 ares. 0.72 m. 0.914 m. 0.485 m. 37.324 kg. 10.583 gm. 1.41 l. 1.00 kg. 11.664 gm.

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Canada <sup>8</sup>	arpent----- minot----- Weights and measures of Great Britain.	0.844 acre----- 1.111 bu-----	34.191 ares. 39.151 l.
Central Amer- ica.	arroba----- cantara----- cuartilla----- fanega----- libra----- vara-----	26.075 lb----- 4.263 gal----- 1.065 gal. or 0.393 gal. 1.574 bu----- 1.043 lb----- 32.874 in-----	11.827 kg. 16.137 l. 4.031 l. or 1.487 l. 55.480 l. 0.473 kg. 0.835 m.
Chile#	fanega----- libra----- cuartillo----- vara-----	2.575 bu----- 1.043 lb----- 10.656 in----- 33.367 in-----	90.743 l. 473.00 gm. 0.27 m. 0.847 m.
China <sup>9</sup>	catty----- chik----- pecul----- shik----- shing-taong----- tael----- yan-----	1.333 lb----- 13.125 in----- 133.333 lb----- 160.00 lb----- 0.55 qt----- 1.333 oz----- 109.375 ft-----	604.78 gm. 0.333 m. 60.478 kg. 72.574 kg. 0.54 l. 37.789 gm. 33.337 m.
Colom- bia.*			
Congo, Bel- gian.	Weights and measures of Bel- gium.		
Cuba*			

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Denmark	alen (aln)---	21.716 in-----	0.627 m.
	centner-----	110.23 lb-----	49.999 kg.
	pund-----	1.102 lb-----	499.856 gm.
	tonde (for grain).-----	3.287 imp. bu-----	119.482 l.
	tondeland -----	1.36 acres-----	5,503.92 m. <sup>2</sup>
	viertel-----	1.701 gal-----	6.438 l.
Egypt#-----	ardeb:		
	dry-----	5.447 bu-----	107.976 l.
	liquid-----	43.579 gal-----	164.946 l.
	diraab aladi-----	29.835 in-----	0.757 m.
	feddan-----	1.038 acres-----	4,200.786 m. <sup>2</sup>
	kantar-----	99.049 lb-----	44.927 kg.
	oke-----	2.75 lb-----	1.247 kg.
	okieh-----	1.32 oz-----	37.420 gm.
	pic-----	9.019 in-----	0.254 m.
	rotl (rotolo)-----	0.981 lb-----	445.41 gm.
France*-----	millier-----	2,204.6 lb-----	1,000.00 kg.
	tonneau-----	2,204.6 lb-----	1,000.00 kg.
Germany.*-----	schoppen---	0.528 qt-----	0.5 l.
	tonne-----	2,204.621 lb-----	1,000.00 kg.
Great Britain. <sup>10</sup>	quart, imp.-----	2.00 pt-----	1.136 l.
	gallon, imp.-----	4.00 qt-----	4.546 l.
	peck, imp.-----	8.00 qt-----	9.092 l.
	bushel, imp.-----	4.00 pk-----	36.37 l.
	chaldron-----	36.00 bu-----	1.309 kl.
	stone-----	14.00 lb-----	6.35 kg.
	(For others, see United States).-----		

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Greece#..	baril (wine).....	16.333 imp. gal.....	74.2 l.
	livre.....	1.05 lb.....	476.269 gm.
	oke.....	2.80 lb.....	1.270 kg.
	piki.....	39.37 in.....	1.00 m.
	stater.....	123.2 lb.....	55.822 kg.
	stremma.....	0.242 acre.....	979.374 m. <sup>2</sup>
Guate- mala#.	arroba.....	25.35 lb.....	11.498 kg.
	cantara.....	4.263 gal.....	16.137 l.
	fanega.....	1.5 imp. bu.....	54.525 l.
	libra.....	1.014 lb.....	459.94 gm.
	quintal.....	101.40 lb.....	45.994 kg.
	tonelada.....	2027.16 lb.....	919.514 kg.
Haiti*..			
Hawaii..	Weights and measures o f t h e U n i t e d S t a t e s .		
Honduras#.	arroba— (wine)....	3.277 imp. gal....	15.90 l.
	(oil).....	2.75 imp. gal.....	12.483 l.
	fanega.....	1.5 imp. bu.....	54.525 l.
	manzana....	1.833 acres.....	7,418.151 m. <sup>2</sup>
	vara.....	32.874 in.....	0.835 m.
Hong- kong. <sup>11</sup>	catty.....	1.333 lb.....	604.78 gm.
	chek.....	14.606 in.....	0.371 m.
	cheung.....	12.187 ft.....	3.714 m.
	picul.....	133.333 lb.....	60.478 kg.
	tael.....	1.333 oz.....	37.789 gm.

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Hungary*	arsin----- fass----- metze----- stab-----	22.992 in----- 52.545 gal----- 1.773 bu----- 62.228 in-----	0.584 m. 198.882 l. 63.48 l. 1.58 m.
Italy*.			
Japan----	cho: linear square ken----- kin----- koku: dry liquid kwan----- ri: linear square shaku----- sun----- to: dry liquid	352.00 ft----- 2.45 acres----- 5.965 ft----- 1.325 lb----- 4.962 bu----- 39.703 gal----- 8.281 lb----- 2.44 mi----- 5.955 sq. mi----- 11.88 in----- 1.193 in----- 1.985 pk----- 3.97 gal-----	107.289 m. 9,915.15 m. <sup>2</sup> 1.818 m. 602.006 gm. 174.86 l. 150.275 l. 3.756 kg. 3.91 km. 15.54 km. <sup>2</sup> 0.3 m. 0.03 m. 17.487 l. 15.016 l.
Liberia--	Weights and measures of Great Britain or United States.		
Mexico <sup>12*</sup>	arroba----- baril----- fanega----- libra----- vara-----	25.357 lb----- 20.00 gal----- 1.55 imp. bu----- 1.014 lb----- 32.90 in-----	11.501 kg. 75.70 l. 56.342 l. 0.46 kg. 0.835 m.

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Nether-lands.*			
Nicaragua.*			
Norway.*			
Panama.*			
Paraguay <sup>13</sup>	arroba.....	25.357 lb.....	11.502 kg.
	fanega.....	1.5 imp. bu.....	54.525 l.
	quintal.....	101.40 lb.....	45.994 kg.
	sino.....	76.66 sq. yd.....	64.102 m. <sup>2</sup>
Persia.....	abbasi.....	5,680.00 gr.....	368.064 gm.
	batman (see <i>man</i> ). . . . .		
	gez.....	40.95 in.....	1.04 m.
	keryankeh.....	5,680.00 gr.....	368.064 gm.
	man <sup>14</sup> .....	6.49 to 116.8 lb.....	2.9 to 52.98 kg.
	miskal.....	71.00 to 154.3 gr.....	4.6 to 10.00 gm.
	sir.....	1,136.00 gr.....	73.613 gm.
	wakkeh.....	5,680.00 gr.....	368.064 gm.
	zar.....	40.95 in.....	1.04 m.
Peru#.....	arroba—		
	liquid.....	6.70 imp. gal.....	30.438 l.
	weight.....	25.36 lb.....	11.503 kg.
	libra.....	1.014 lb.....	459.94 gm.
	ounce.....	1.014 oz.....	28.746 gm.
	quintal.....	101.398 lb.....	45.994 kg.
	vara—		
	linear.....	33.367 in.....	0.847 m.
	square.....	7.731 sq. ft.....	0.718 m. <sup>2</sup>

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Philip-pines. <sup>15</sup>	anega (dry).....	2.724 qt.....	2.999 l.
	apatan:		
	dry.....	0.085 qt.....	0.094 l.
	liquid.....	0.085 qt.....	0.081 l.
	arroba:		
	liquid.....	16.907 qt.....	16.00 l.
	weight.....	25.35 lb.....	11.502 kg.
	balita.....	110.320 sq. rd.....	27.90 ares.
	bitic.....	16.538 sq. rd.....	4.183 ares.
	catty.....	1.38 lb.....	632.64 gm.
	cavan.....	2.128 bu.....	75.00 l.
	fanega.....	1.574 bu.....	55.50 l.
	ganta.....	2.724 qt. (dry).....	2.999 l.
	legua (lagua, league).....	3.462 mi.....	5.573 km.
	line.....	0.83.....	0.002 m.
	onza.....	1.002 oz.....	29.00 gm.
	palma.....	7.874 in.....	0.20 m.
	pico, picul <sup>16</sup> .....	139.467 lb.....	63.262 kg.
	quintal.....	101.403 lb.....	46.009 kg.
	real.....	0.431 acre.....	1,746.875 m. <sup>2</sup>
	tael.....	603.848 gr.....	39.00 gm.
	vara—		
	linear.....	32.913 in.....	0.836 m.
	square.....	8.356 sq. ft.....	0.6987 m. <sup>2</sup>
Puerto Rico.#			
Portugal*	almude:		
	(Lis- bon).....	3.7 imp. gal.....	16.809 l.
	(Opor- to).....	5.6 imp. gal.....	25.44 l.
	alqueire		
	(Lisbon).....	0.36 bu.....	12.686 l.
	arroba.....	32.379 lb.....	14.687 kg.

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Portugal— Continued.	libra-----	1.012 lb-----	459.033 gm.
	moio-----	77.64 lb-----	35.185 kg.
	tonelada-----	94.588 imp. gal-----	429.998 l.
	vara-----	43.28 in-----	1.099 m.
Roumania.*			
Russia---	arshin (archine).-----	28.00 in-----	0.711 m.
	chetverik-----	0.698 imp. bu-----	25.398 l.
	chetvert-----	5.592 imp. bu-----	203.37 l.
	dessiatine-----	2.699 acres-----	1.922 ha.
	poed (poud, pood).-----	36.00 lb-----	16.329 kg.
	pound-----	0.9 lb-----	408.00 gm.
	sajene (sachine).-----	7.00 ft-----	2.133 m.
	vedro-----	2.705 imp. gal-----	12.278 l.
	verst----- linear-----	0.6586 mi-----	1.06 km,
	square-----	0.439 sq. mi-----	113.704 ha.
Siam----	zolotnik-----	65.83 gr-----	4.265 gm.
	chang-----	2.638 lb-----	1.197 kg.
	cohi-----	13.385 gal-----	50.666 l.
	hap-----	133.333 lb-----	60.478 kg.
	keup-----	19.921 in-----	0.506 m.
	niu-----	1.666 in-----	0.042 m.
	sok-----	39.803 in-----	1.011 m.
	vouah-----	6.306 ft-----	1.922 m.
Spain#----	arroba----- (wine)-----	2.75 imp. gal-----	12.49 l.
	(oil)-----	3.5 imp. gal-----	15.89 l.
	fanega-----	1.5 imp. bu-----	54.525 l.
	libra-----	1.014 lb-----	459.94 gm.

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
Spain— Continued.	pie-----	11.128 in-----	0.283 m.
	cuartillo-----	101.40 lb-----	45.994 kg.
	vara-----	33.385 in-----	0.848 m.
Sweden.*			
Switzer- land.*	arpent-----	0.888 acre-----	3,593.736 m. <sup>2</sup>
	centner-----	115.20 lb-----	52.255 kg.
Turkey <sup>17*</sup>	almud-----	1.151 imp. gal-----	5.228 l.
	arshin (archine).-----	29.528 in-----	0.750 m.
	cantar-----	125.00 lb-----	56.698 kg.
	endaze (en- daseh).-----	25.70 in-----	0.652 m.
	kile-----	0.36 imp. qt-----	0.408 l.
	kileh-----	0.883 imp. bu-----	32.138 l.
	kintal-----	125.00 lb-----	56.698 kg.
	oka-----	2.833 lb-----	1.284 kg.
United States <sup>18#</sup> .	inch-----	1.00 in-----	2.540 cm.
	foot-----	12.00 in-----	0.3048 m.
	yard-----	3.00 ft-----	0.9144 m.
	rod-----	16.50 ft-----	5.0290 m.
	fathom-----	6.00 ft-----	1.829 m.
	mile-----	5,280.00 ft-----	1.6093 km.
	inch, square-----	1.00 sq. in-----	6.452 cm. <sup>2</sup>
	foot, square-----	144.00 sq. in-----	0.0929 m. <sup>2</sup>
	yard, square-----	9.00 sq. ft-----	0.8361 m. <sup>2</sup>
	rod, square-----	272.25 sq. ft-----	25.29 m. <sup>2</sup>
	acre-----	4,840.00 sq. yd-----	0.4047 ha.
	mile, square-----	640.00 acres-----	2.590 km. <sup>2</sup>
	inch, cubic-----	1.00 cu. in-----	16.387 cm. <sup>3</sup>
	foot, cubic-----	1,728.00 cu. in-----	0.0283 m. <sup>3</sup>
	yard, cubic-----	27.00 cu. ft-----	0.7646 m. <sup>3</sup>
	pint, dry-----	1.00 pt-----	0.5506 l.
	quart, dry-----	2.00 pt-----	1.101 l.

See footnotes at end of table.

Country	Weight or measure	English or American equivalent	Metric equivalent
United States—Continued.	gill, liquid	1.00 gill	0.118 l.
	pint, liquid	4.00 gills	0.473 l.
	quart, liquid.	2.00 pt	0.9463 l.
	gallon	4.00 qt	3.785 l.
	peck	8.00 qt	8.810 l.
	bushel	4.00 pk	35.24 l.
	grain	1.00 gr	0.0648 gm.
	ounce, avdp	437.50 gr	28.35 gm.
	pound, avdp	7,000.00 gr	453.59 gm.
	ton, long	2,240.00 lb	1.016 met. tons.
	ton, short	2,000.00 lb	0.907 met. tons.
	penny-weight.	24.00 gr	1.555 gm.
	ounce, troy	480.00 gr	31.103 gm.
	pound, troy	5,760.00 gr	373.20 gm.
Uruguay*	arroba	25.348 lb	11.498 kg.
	cuadra	1.8 acres	7,284.60 m.
	fanega	30.00 gal	113.55 l.
	quintal	101.40 lb	44.994 kg.
Venezuela. <sup>18#</sup>			

<sup>1</sup> Abbreviations used in the table:

avdp	avoirdupois	km. 2	square
bu	bushel	l	liter
cm	centimeter	lb	pound
cm. 2	square centimeter	m	meter
cm. 3	cubic centimeter	m. 2	square meter
ft	foot	m. 3	cubic meter
gal	gallon	met	metric
gm	gram	mi	mile
gr	grain	oz	ounce
ha	hectare	pk	peck
imp	imperial	pt	pint
in	inch	qt	quart
kg	kilogram	rd	rod
kl	kiloliter	sq	square
km	kilometer	yd	yard

<sup>2</sup> The weights and measures of Afghanistan are like those of Arabia, India, and Persia.

<sup>3</sup> The metric system is legal and obligatory. Compare Hungary.

<sup>4</sup> These names are used only occasionally.

<sup>5</sup> The Spanish measures are still in use.

<sup>6</sup> The former Portuguese system is still largely used.

<sup>7</sup> A great variety of weights and measures, more than can be here enumerated, are found in different provinces. Grains and liquids are measured largely by weight.

<sup>8</sup> The weights and measures of Canada are the same as those of Great Britain, but in some parts of lower Canada various old French terms are still in use.

<sup>9</sup> In China almost everything is sold by weight, so that dry and liquid measures are little used.

<sup>10</sup> The weights and measures of Great Britain are practically the same as those of the United States, which are derived from them. The common United States standard (Winchester) gallon contains 231 cubic inches; the British imperial gallon contains 277.274 cubic inches. The United States standard (Winchester) bushel contains 2,150.4 cubic inches; the British imperial bushel contains 2,218.2 cubic inches. Certain British units little used in the United States are noted in the table.

<sup>11</sup> The weights and measures of Great Britain are in general use in Hongkong.

<sup>12</sup> The old Spanish weights and measures are still in use—Statesman's Year-book (1932).

<sup>13</sup> The weights and measures of Argentina are also in general use.

<sup>14</sup> The *mans* are many and various, from the *man-i-tabric* (6.49 pounds; 2.933 kilograms) to the *man-i-hasheni* (116.8 pounds; 52.98 kilograms).

<sup>15</sup> The metric system was in use at the time the United States took possession, and its continued use was authorized by the Philippine Commission 17 September 1901. The names of the weights and measures given in the table are from the official tables of the United States Census of the Philippine Islands, 1903, volume IV, pages 448 et seq. Great variations in the quantities represented by these names are found in different islands and provinces.

<sup>16</sup> The pico varies from 39 kilograms in Sorsogon to 69.012 kilograms in Leyte.—*Ibid.*, page 447. Other weights or measures of the old system vary in a similar way.

<sup>17</sup> The metric system of weights and measures became general as from 1 January 1933.

<sup>18</sup> The metric system of weights and measures became the official system as of 18 May 1912.

\*The metric system is legal and obligatory; however, the old weights and measures may still be in use.

#The metric system is legal but not obligatory or not in general use among the people.

### 63. CONVERSION OF U. S. TO METRIC MEASURE

U. S. (or Imperial)	Metric	Conversion factor
Acres	Hectares	0.4047
Cubic feet	Cubic meters	.0283
Cubic inches	Cubic centimeters	16.3872
Do	Liters	.0164
Cubic yards	Cubic meters	.7646
Feet	Meters	.3048
Feet per second	Meters per minute	18.288
Gallons (Imperial)	Liters	4.543
Gallons (U. S.)	do	3.7853
Grains	Grammes	.0648
Hundredweights	Quintals	.508
Inches	Centimeters	2.5399
Do	Meters	.0254
Do	Millimeters	25.4001
Miles	Kilometers	1.6093
Miles per hour	Meters per second	.447
Ounces (avdp.)	Grammes	28.349
Do	Kilogrammes	.02835
Pints (Imperial)	Liters	.568
Pints (U. S.)	Liters	.4732
Pounds (avdp.)	Kilogrammes	.45359
Square feet	Square meters	.0929
Square inches	Square centimeters	6.4516
Square miles	Square kilometers	2.590
Square yards	Square meters	.8361
Yards	Meters	.914

## 64. CONVERSION OF METRIC TO U. S. MEASURE

Metric	U. S. (or Imperial)	Conversion factor
Centimeters	Inches	0.3937
Cubic centimeters	Cubic inches	.0610
Cubic meters	Cubic feet	35.3144
Do	Cubic yards	1.3079
Grammes	Grains	15.4324
Do	Ounces (avdp.)	.03527
Hectares	Acres	2.4710
Kilogrammes	Pounds (avdp.)	2.2046
Do	Ounces (avdp.)	35.2739
Kilometers	Miles	.62137
Liters	Cubic inches	61.025
Do	Gallons (Imperial)	.220
Do	Gallons (U. S.)	.26418
Do	Pints (Imperial)	1.76
Do	Pints (U. S.)	2.1134
Meters	Feet	3.2808
Do	Inches	39.37
Do	Yards	1.0936
Meters per minute	Feet per second	.0547
Meters per second	Mph	2.237
Metric ton	Pounds	2,204.6
Millimeters	Inches	.0393
Quintals	Hundredweights	1.97
Square centimeters	Square inches	.155
Square kilometers	Square miles	.3861
Square meters	Square yards	1.1960
Do	Square feet	10.764

## 65. MISCELLANEOUS CONVERSIONS

From—	To—	Conversion factor
Cubic feet.....	Gallons (U. S.).....	7.481
Feet per minute.....	Miles per hour.....	.01137
Feet per second.....	do.....	.6818
Gallons (imperial).....	Cubic feet.....	.1605
Gallons (U. S.).....	do.....	.1337
Gallons (imperial).....	Gallons (U. S.).....	1.201
Gallons (U. S.).....	Gallons (imperial).....	.8327
Inches.....	Yards.....	.0277
Knots.....	M.p.h.....	1.1516
Miles.....	Feet.....	5,280
Miles per hour.....	Feet per minute.....	88
Do.....	Feet per second.....	1.467
Do.....	Knots.....	.8684
Rods.....	Yards.....	5.5
Tons, long.....	Pounds.....	2,240
Tons, short.....	do.....	2,000
Tons, long.....	Tons, short.....	1.12
Tons, short.....	Tons, long.....	.893
Tons, long.....	Tons, ship.....	2.464
Tons, ship.....	Cubic feet.....	40
Tons, register.....	do.....	100

## 66. TEMPERATURE CONVERSION

$$\text{Centigrade} = \frac{5}{9} (\text{F} - 32)$$

$$\text{Fahrenheit} = \frac{9}{5}\text{C} + 32$$

$$\text{Centigrade} = \frac{5}{4}\text{R}$$

$$\text{Reaumur} = \frac{4}{5}\text{C}$$

$$\text{Fahrenheit} = \frac{9}{4}\text{R} + 32$$

$$\text{Reaumur} = \frac{4}{9} (\text{F} - 32)$$

## 67. CUBIC MEASURE

$$1728 \text{ cubic inches} = 1 \text{ cubic foot}$$

$$27 \text{ cubic feet} = 1 \text{ cubic yard}$$

## 68. SQUARE MEASURE

144 square inches	= 1 square foot
9 square feet	= 1 square yard
4,840 square yards	= 1 acre
70 yards square	= 1 acre (approximately)
43,560 square feet	= 1 acre
640 acres	= 1 square mile
272½ square feet	= 1 square rod (perch)

## 69. LINEAR MEASURE

16½ feet	= 1 rod
5½ yards	= 1 rod
40 rods	= 1 furlong
8 furlongs	= 1 mile
320 rods	= 1 mile
1,760 yards	= 1 mile
5,280 feet	= 1 mile
3 miles	= 1 league

## 70. VOLUME

1	2	3	4	5	6
Unit	Cubic feet	Imperial gallon	U. S. gallon	Liters	Quarts
One cubic foot	=	6.229	7.481	28.32	29.92
One Imperial gallon	=	.16054		1.2010	4.546
One U. S. gallon	=	.13368	.8327		3.785
One liter	=	.03532	.2201	.2642	
One measurement ton	=	40			1.0567

## 71. MARINER'S MEASURE

6 feet	= 1 fathom
100 fathoms	= 1 cable length
7½ cable lengths	= 1 mile
5,280 feet	= 1 statute mile
6,080.2 feet	= 1 nautical mile

## 72. MEASURES OF WEIGHT

<i>Metric</i>	<i>U. S. (or British) (avoirdupois)</i>
Millier (tonneau, metric ton)-----	2,204.6 pounds.
Quintal-----	220.46 pounds.
Myriagram-----	22.046 pounds.
Kilogram-----	2.2046 pounds.
Hectogram-----	3.5274 ounces.
Decagram-----	.3527 ounces.
Gram-----	15.432 grains.
Decigram-----	1.5432 grains.
Centigram-----	.1543 grains.
Milligram-----	.0154 grains.

## 73. MEASURES OF LENGTH

<i>Metric</i>	<i>U. S. (or British)</i>
Myriameter-----	6.2137 miles.
Kilometer-----	.62137 mile.
Hectometer-----	328 feet 1 inch.
Decameter-----	393.7 inches.
Meter-----	39.37 inches.
Decimeter-----	3.937 inches.
Centimeter-----	.3937 inch.
Millimeter-----	.03937 inch.

## 74. WEIGHT

1	2	3	4	5	6
Unit	Long tons	Metric tons	Short tons	Kilo-grams	Pounds
1 long ton-----		1.0160	1.1200	1,016.	2,240.
1 metric ton-----	0.9842		1.1023	1,000.	2,204.6
1 short ton-----	.8929	.9072		907.2	2,000.
1 kilogram-----					2.2046

## 75. SHIPPING EQUIVALENTS

Weight	Equivalent
Average short ton of military supplies with stowage.	2.2 ship (measurement) tons.
Average short ton of military supplies without stowage.	1.9 ship (measurement) tons.
Average long ton of military supplies with stowage.	2.464 ship (measurement) tons.
Ship (measurement) tonnage	Bale cubic capacity 40
Deadweight tonnage	.85 ship (measurement) tonnage.
Effective deadweight tonnage	.80 deadweight tonnage.
Deadweight tonnage	1.5 gross registered tonnage.
Gross tonnage	.6 deadweight tonnage. <sup>1</sup>
Net tonnage	.4 deadweight tonnage. <sup>1</sup>

<sup>1</sup> Approximate relation of freight ships of 10,000 deadweight tons.

## 76. MEASUREMENT OF SURFACES AND SOLIDS

Figure	Relation	Measurement
Circumference of a circle	equals ..	Diameter times 3.1416.
Area of a triangle	equals ..	Base times altitude divided by 2.
Area of a square or an oblong.	equals ..	Length times breadth.
Area of a circle	equals ..	Square of the diameter times .7854. or Square of the radius times 3.1416.
Area of the sector of a circle	equals ..	Length of the arc times the radius divided by 2.

Figure	Relation	Measurement
Area of any right-lined figure of four or more unequal sides.	equals ..	Division of the figure into triangles, finding of the area of each triangle, and adding of the areas.
Area of an ellipse-----	equals ..	Long axis times the short axis times .7854 (length times perimeter).
Surface of a cone or a pyramid.	equals ..	One-half of slant height times perimeter of base plus area of base.
Surface of a cube-----	equals ..	Sum of areas of all the sides.
Surface of a sphere-----	equals ..	Square of the diameter times 3.1416.
Cubic content of a prism or cylinder.	equals ..	Area of the base times the height.
Cubic content of a cone or a pyramid.	equals ..	$\frac{1}{3}$ (area of base times altitude).
Surface of a prism or a cylinder.	equals ..	Area of 2 ends plus (length times perimeter).
Cubic content of a cube----	equals ..	Length times breadth times depth.
Cubic content of a sphere--	equals ..	Cube of the diameter times .5236.

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